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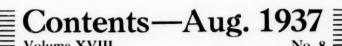
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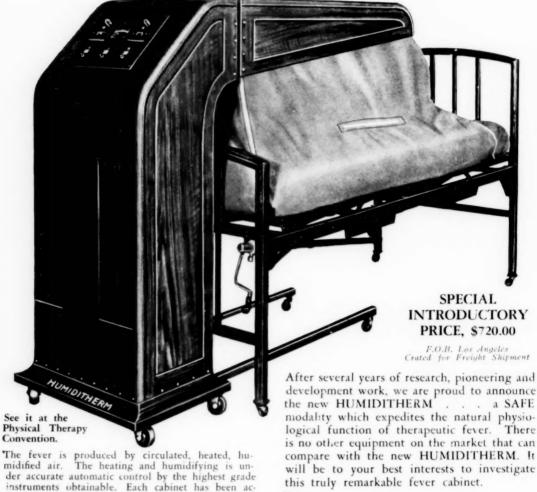
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PHYSIOLOGIC EFFECT OF CARBON-DIOXIDE BATHS ON THE CIRCULATORY SYSTEM *

FRANZ M. GROEDEL, M.D.

NEW YORK

About the middle of the last century, Beneke, an anatomist and clinician at the University of Marburg, discovered the therapeutic value of carbon-dioxide baths in the treatment of chronic cardiac conditions. At that time, he was, in addition to being the head of the University clinic, one of the physicians at Bad Nauheim.

Baths rich in salt were then used only for the treatment of rheumatic conditions, and it was generally considered that the salt bath as well as the ordinary water bath was contraindicated in the cardiac patient. Beneke found, however, that in a rheumatic patient with cardiac failure not only was the rheumatic condition improved but also the cardiac state under a mineral bath cure.

Beneke's discovery was not at all an accidental one. It was actually the result of very exact clinical observations and the thoroughness with which he examined many patients. Nevertheless, we know today that the conclusion at which he arrived regarding the effects of his treatment was incorrect because rheumatic changes in the cardiac valves are rarely successfully influenced by therapeutics. The same may be said about his opinion that the effectiveness of the Nauheim baths in cardiac cases is due to their salt content.

Groedel I, Schott, and Jacob were the first physicians to recognize that it was the carbon-dioxide content of the springs which was the important agent in producing the favorable effect of the baths. Their observations, as well as those of other physicians concerned with this problem, were based upon clinical study alone, for, as yet, exact experiments had not been developed to substantiate clinical impressions. Nevertheless, as early as 1880, Groedel I noted the effect of the carbon-dioxide baths upon the respiratory apparatus and carried out experiments with the Waldenburg spirometer which have since been corroborated by workers with modern and refined methods. His experimental findings, however, led to very important conclusions.

By the end of the nineteenth century, there had arisen two schools. One was led by Groedel I who, as early as 1878, likened the effect of the baths to that of digitalis. In other words, he took the stand that the carbon-dioxide bath acts primarily by soothing and relieving, and secondarily by exercising the heart. The opposing school, headed by A. Schott, upheld the theory that the carbon-dioxide effect upon the heart is similar to that of exercising in a gymnasium, that is, it acts only through training and not through relaxing the heart.

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Experimental proof of the physiologic effects of mineral baths upon the cardiovascular system was not really forthcoming until the beginning of this century. It paralleled the development of methods of measuring blood pressure, radiology, electrocardiography, and of testing the capacity of the circulatory apparatus. For a long time, however, experiments did not extend beyond those carried out by physicians whose practice was confined chiefly to the spas. Recently, however, in several of the European spas research laboratories have been installed, many of which are today connected with neighboring universities.

^{*} Read at the Fifteenth Annual Session of the American Congress of Physical Therapy, New York City, September 9, 1936.

General Remarks

The effect of the carbon-dioxide bath can be determined only by comparing it with that of the simple water bath, the salt bath, and the like. One must also study each of the factors and agents which produce the effect of the carbon-dioxide upon the system. Chief among these are the following:

- 1. Mechanical Factors:
 - (a) Water pressure.
 - (b) Buoyancy of the water.
 - Massaging effect on the skin of the gas bubbles. (c)
- 2. Thermic Factors:
 - (a) Water temperature.
 - (b) Gas temperature.
- 3. Chemical Factors:
 - (a) Gas.
 - (b) Salts contained in the water.

The therapeutic result is achieved through the following starting points:

- The skin and its organs.
- The deeply situated vessels.
- Respiratory organs.
- 4. Central nervous system.

Until a few years ago, the skin was regarded chiefly as a protective organ for the body and as a poor conductor of electricity and heat. We knew only that the skin perceives the stimuli of its environment mainly through its temperature and pain sensitive nerve endings. Today, however, it is well known that the skin with its imbedded organs is one of the most important systems of metabolism in the body.

With regard to the deeply situated vessels, we know that the veins of the extremities are influenced in the bath, and indirectly, the arteries, by relaxation of the muscles.

The function of the respiratory organs is altered due to definite changes in the pressure in the large cavities of the body which take place during the bath. On the other hand, inhaled carbon-dioxide has no similar therapeutic effect. This is proved by the fact that the results remain the same if the possibility of inhalation of carbon-dioxide is excluded. Furthermore, we have proved that the carbon-dioxide in the air above the water of the natural carbondioxide bath contains no more than an average of 0.5 volume per cent of this gas. Attention was called to this by us a number of years ago and many institutes have since confirmed this finding.

From the foregoing brief resumé of the various factors involved in the therapeutic effect of the bath, we see that the influence of the carbon-dioxide bath is not limited to the body surface. On the contrary, the picture is much more complicated. The mechanical factor of the mineral bath is effective on the surface of the skin in that the gas bubbles serve to massage the sensitive tactile nerve endings. The hydrostatic pressure, in turn, works cutaneously especially upon the capillaries and acts subcutaneously through pressure upon the veins of the extremities. Finally the mechanical factor affects the organs in the cavities of the body by altering the intra-abdominal and intra-thoracic pressure. At the same time the buoyancy of the water, which is particularly high in the carbon-dioxide bath, has an important relaxing effect on muscular tone, hence on the arterial circulation.

The thermic factor is effective only cutaneously, through stimulation of heat sensitive nerve endings. Until recently thermic stimulation was thought to be the chief means by which the carbon-dioxide bath produced its beneficial results, but this is not wholly correct. Experiments have demonstrated conclusively that the physiologic and therapeutic effect is the same when the stimulus of heat is eliminated by giving a bath of indifferent temperature so that it felt neither hot nor cold. Furthermore, the best therapeutic result is obtained by selecting an individually indifferent temperature, for every person feels a bath to be warm or cold in varying degrees, as I pointed out long ago.

Naturally one must consider that the carbon-dioxide bath produces a heat sensation at a temperature far below the temperature at which the ordinary water bath is felt to be warm. Upon this fact the theory of the effect of temperature contrast has been built up. Goldscheider believed that the contrast between the temperature sensation of the water and the gas to the body is the main factor in the effectiveness of the carbon-dioxide bath and for two decades this hypothesis influenced the general opinion, though today it is not accepted.

The chemical elements, gas and salt, work first of all, cutaneously. They excite nerve endings and also penetrate the skin. This was first explained in an obscure book written by Boehrig in 1876. Hediger, not knowing of Boehrig's experiments and work, called attention to this again recently, and through determination of basal metabolism in the bath Wachter and I have furnished the last link in the chain of proof in this regard. Furthermore, the effect of the salts is unquestionably due to the permeability of the skin, as shown lately by Harpuder. But as salts and gas penetrate the skin, naturally they exert an effect not only cutaneously but upon all the cells and organs of the body.

Finally, attention must be called to the fact that many controversies have arisen in the European literature on the effect of bath cures using carbon-dioxide water, due to two reasons:

1. The question of what water is used is not at all unimportant. We know through experiments conducted in our Institute that dry carbon-dioxide does not, or at most, barely penetrates the skin. On this point the opinions of the older physiologists could not be shaken. On the other hand, on the basis of our experiments and from observing patients' reactive phenomena, it has become recognized that moist carbon-dioxide as well as carbon-dioxide dissolved in water diffuses through artificial and natural membranes as well as through the skin of human beings. The conclusion reached is that carbon-dioxide baths are most effective the better the carbon-dioxide is dispersed through water and bound to it. The natural warm springs respond best to this demand. In recent years, research has had as its chief aim the achievement of an artificial carbon-dioxide bath that will imitate the natural condition as closely as possible.

2. The second cause for the divergence of opinions lies in the fact that experiments are performed with very different and often very incomplete technics. During the last thirty years we have been developing a technic to eliminate as far as possible the various causes of error. This has now been in use for several years in the Kerckhoff Research Institute in Bad Nauheim. Other institutes, such as those in Bad Salzuffeln, Bad Oeynhausen and Saratoga Springs, have also adopted this technic, details of which cannot be given here.

If, now, I were to enumerate the physiologic effects of the carbon-dioxide bath in full, I could not begin to relate historically the developmental steps of our present knowledge. So I shall limit myself to the presentation of the most recent phases of progress.

Pulse

We know that the pulse increases in a cold water bath, but its frequency also is increased in a warm bath. Only the bath of neutral or indifferent temperature (neither warm or cold to the patient) will not influence the pulse rate. Even to make this most simple observation there must be a proper and precise technic of the bath. The natural carbon-dioxide bath of neutral or

indifferent temperature will lower the pulse rate of the normal person after a very brief initial period of rise. This is true also in cardiac patients. Naturally in easily excitable patients the soothing effect on the pulse becomes apparent only after a number of baths. In certain patients, as will later be discussed, full baths are contraindicated by their condition. The pulse frequency of these patients diminishes in a half bath, whereas the full bath increases it.

As already indicated, in view of the effects of the bath upon pulse frequency and other factors to be mentioned, the importance of a very careful bath technic cannot be overestimated. Every bath, especially the strong carbon-dioxide bath, has a distinct buoyancy. Each bather battles against this buoyancy by definite muscle tension. Muscle work naturally increases pulse frequency. But if one grasps the patient in a certain manner and balances the extremities with a light sand bag, the pulse rate will drop from the beginning of the carbon-dioxide bath if it is of neutral or indifferent temperature.

Blood Pressure

Great care must also be exercised in noting the patient's blood pressure reactions. Attention to this point has been stressed in the findings of various early experimenters. In a cold bath, the blood pressure increases and remains high; in the warm bath it increases at the beginning and diminishes later. A bath of neutral or indifferent temperature, however, affects it only slightly. The carbon-dioxide bath, however, lowers the blood pressure, as was pointed out by Groedel I in 1896. In 1906, I made exact measurements of this with Groedel II, and we succeeded in showing that a slight increase can precede the depression. At the same time we demonstrated that even in cases with hypertension the pressure can be lowered when half baths are prescribed. The pressure amplitude becomes smaller in the cold bath; greater in the warm. Strassburger was the first to show that diastolic pressure falls in the carbon-dioxide bath. A graphic demonstration of the increase in blood pressure — amplitude in the carbon-dioxide bath was made in experiments that I conducted in the Kerckhoff Institute with McLellan in 1932.

It is apparent, therefore, that through pulse and blood pressure observations during the bath one may draw certain conclusions regarding the working capacity of the heart. However, before judging this working capacity of the heart, one must be familiar with a number of the factors upon which it depends.

Effect of Water Pressure Upon Circulation

Hydrostatic pressure was disregarded, at one time, as a factor in the favorable effect of the bath. If one considers the low pressure in the superficial venous network on the one hand, and how complicated is the mechanism of the venous circulation on the other, it is readily understandable — as I mentioned years ago — that a 20-50 cm. column of water pressing above the body must easily influence circulatory conditions. The superficial capillaries and veins become compressed under it; the venous blood is shunted toward the heart; the muscles become relaxed and the arterial circulation is lightened.

Water pressure likewise has an effect on the cavities of the body. Bock found that the intra-abdominal pressure increases 18 cm. in a bath. Here, too, the venous flow is increased. Finally, according to Schott and others, the intra-thoracic pressure increases 5 to 10 cm. in the bath. This Strassburger ascertained when, in 1909, he measured metrically the compression of the thorax in a full bath. Since intra-thoracic pressure represents the zero point for pressure in the right auricle as well as the systolic tension time, one may suppose, as mentioned by Gollwitzer-Meier that there is an improvement in the systolic work of the heart as a result of the bath.

One must therefore not lose sight of the fact that the congested lungs of the cardiac patient are scarcely compressible. Intra-thoracic pressure in such patients, however, may be easily increased by the full bath above the functional optimum point. Here, again, the old warning of the practical balneologist must be remembered, one must give only half baths, at least in the beginning, in the severe case.

Effect of the Bath Upon the Skin Capillaries

Special discussion is needed in regard to the effect of the bath upon the skin because hydrostatic and other factors mentioned in their action on the total circulatory system must have an especially marked influence on the great capillary network and the nerve system situated in the skin.

I have already mentioned that for a long time we considered the sensitivity of the skin to temperature as the only effective factor in every kind, particularly the carbon-dioxide bath. In this regard Goldscheider's theory is the most radical, adopting the standpoint that the specific effect of the carbon-dioxide bath lies in the contrast between the temperature sensation caused by the water and the carbon-dioxide bubbles. In any case, this factor has been highly overestimated. It was forgotten that many other stimuli and many other types of bath have a similar effect on the autonomic nervous system. We believe therefore that Lampert in his recent publication overestimates this effect.

Today we know that the vascularization of the capillaries is not only increased in the hot bath, as Mueller, Benatt and others have shown, but the capillaries are dilated, new ones open up, and deeply situated veins empty themselves. Landis has proved through micropuncture of the capillaries and veins that the pressure in the arterial loop increases fourfold above the normal value. Through this enormous increase of the end pressure of the arterial system the venous return to the heart is eased.

In the cold bath, many capillaries are contracted. But this ill effect on the capillary circulation is compensated by the fact that under the influence of the cold bath the arteriovenous anastomoses, the short circuits of the vascular system are opened. The result of this is quite obvious. The blood is protected against any great loss of heat.

In the carbon-dioxide bath of indifferent or neutral temperature, there is, as shown by Benatt, a similar change in the capillaries as in the warm bath. In other words, the carbon-dioxide and the warm bath affect the capillaries in a similar manner.

The reddening of the skin that is observed in warm water and especially in carbon-dioxide baths is accordingly due to an improvement in the capillarization of the skin. This capillarization eases the circulation, and blood is brought out of its depots into the circulation, at the same time improving the regulation of the temperature and water balance of the body. Finally the increased capillarization may be also responsible for the improved diuresis which follows any bath, but especially the carbon-dioxide bath.

There can be little, if any, difference of opinion regarding the question how the CO₂ enters the capillaries. The tactile stimulus of the carbon-dioxide bubbles on the nerve endings, which at one time was considered exceedingly important, no longer enters into consideration since experiments carried out by Fellner and by myself have shown that the same reddening of the skin appears in the carbon-dioxide water bath and in the carbon-dioxide gas bath. The conclusion is that the carbon-dioxide penetrates the skin. In our Institute it was shown that carbon-dioxide is diffusable through membranes and the skin only in a moist or suspended state. The degree or amount of diffusion of the gas depends upon the difference in tension between the carbon-dioxide in the

bath and in the blood. Thus if the skin vascularization is increased under the influence of the bath, more carbon-dioxide must pass over. It is therefore advisable not to give a carbon-dioxide bath too cold. This fully agrees with my oft repeated warning that one should not verge too far from the neutral or indifferent point of temperature.

Influence of the Carbon-Dioxide Bath Upon Metabolism

That carbon-dioxide from the carbon-dioxide gas bath and from the carbon-dioxide water bath enters the blood is not easily shown in a simple blood examination, for the carbon-dioxide level of the blood is seemingly constant and can hardly be influenced. In a brief resumé, I shall give the results found through the combined work of Wachter and myself, when we determined the basal metabolism of cardiacs and non-cardiacs in fresh water, salt water, and in carbon-dioxide water and gas baths.

- 1. In fresh water baths of neutral or indifferent temperature, the oxygen consumption increases 5-8 per cent, whereas the carbon-dioxide production remains constant, in only rare instances increasing from 1 to 5 per cent.
- 2. Salt baths in various concentrations show practically an identical picture.
- 3. Contrary results occur in natural warm salt baths with carbon-dioxide. The carbon-dioxide elimination and the respiratory quotient increases in every case, whereas oxygen consumption either diminishes or increases to a negligible degree. The respiratory volume curve is increased in proportion to the elimination of carbon-dioxide. On the other hand, the body temperature and pulse rate diminish in a parallel relationship.
- 4. In the carbon-dioxide bath of cold or warm temperature, the oxygen curve also changes. It distinctly increases the colder the bath, but changes only a little if the bath is of higher temperature.
- 5. The longer the carbon-dioxide bath is given, the greater the increase in carbon-dioxide elimination. This increase, however, is most apparent during the first eight minutes; after that, it is relatively slight.
- 6. At the end of the bath, the oxygen curve returns to normal, if changed at all, but the carbon-dioxide elimination remains high for a longer time. In some instances it returns to normal within one hour, in others not until two hours have passed. The greatest lasting effect of the bath is on the body temperature, which does not return to normal before two or three hours.
- 7. In the air bath, the reaction is similar to that of a fresh water bath; on the average, even less. In general, the respiratory quotient diminishes.
- 8. The artificial carbon-dioxide gas bath gives varying results, depending on the individual. In general, the respiratory quotient and the temperature increase.
- Definite changes similar to those seen in the carbon-dioxide water bath occur in the carbon-dioxide gas bath of neutral or indifferent temperature, the gas of which is moist.
- 10. In oxygen and foam baths the respiratory quotient is not specifically changed.

Summarizing our results, we find:

- (a) In carbon-dioxide baths the respiratory quotient is changed in a manner that cannot be imitated by other physical methods.
- (b) Generally, carbon-dioxide elimination is greatly increased without a corresponding increase in oxygen consumption.
 - (c) In carbon-dioxide baths the carbon-dioxide diffuses through the skin.
- (d) This diffusion depends chiefly on the binding of the carbon-dioxide gas with water.

(e) The optimum effect of the carbon-dioxide bath appears after eight minutes, but the effect of the bath actually lasts for two hours.

The foregoing results, or findings, sustain the following rules formerly

laid down by us:

a. In general, baths should be of short duration and of neutral or indifferent temperature.

b. The patient should rest for one or two hours after a bath, and, above all, he must not be disturbed during this period by salt rubbing or massage.

In addition to the diffusion of carbon-dioxide through the skin, there is another source of increasing the carbon-dioxide in the skin that must not be overlooked. It is known physiologically that a small part of the carbon-dioxide of the body is eliminated through the skin. Krogh has shown that this exit of the carbon-dioxide through the skin is dependent upon the difference in tension of the carbon-dioxide in the skin and in the atmosphere, that is, in the surrounding medium. The difference in tension on the average is 40 mm. of mercury. The amount perspired through the skin is 1.3 cc. per sq. cm. The carbon-dioxide tension in the carbon-dioxide bath is at least 600 mm. of mercury, possibly more. The difference in the gas pressure between the skin and its surrounding medium, that is, from without to within, is approximately 500 mm. of mercury. It is apparent, therefore, that the effectiveness of the bath is at least partially dependent upon retention of carbon-dioxide in the skin.

This theory that I have developed — namely, that a part of the physiologic effect of the carbon-dioxide bath is due to the retention of carbon-dioxide in the skin — has not been accepted by all authors. In favor of my theory is the fact that the increase of carbon-dioxide in the blood during the bath is comparatively small. Against my idea speaks the fact that in the carbon-dioxide bath the amount of retained gas is small compared to the amount that may penetrate the skin. But regarding the question of how much gas may really penetrate the skin, the opinions of various authors are very divergent. So, after all, we must come to the conclusion that we have proved it to be a fact that carbon-dioxide is retained in the skin and penetrates the body from the baths, so that both factors together exert an influence.

Effect of Carbon-Dioxide and Temperature Upon the Cells of the Skin

In a lecture, in 1922, I discussed the fact that the carbon-dioxide baths have an effect on the cells of the skin by influencing its internal secretory function. Today the mechanism of this effect is better understood than formerly. Lewis has shown conclusively that the warm water bath exercises an influence not only on the capillaries of the skin, but, what is more important, on its cells, and that this stimulus of warmth causes the cells to produce a histamin-like substance. This, in turn, brings about capillary dilatation, excites the sensory nerve endings and leads to dilatation of even distant vessels. Gollwitzer-Meier and Bingel have also demonstrated that as a result of the stimulation of the parasympathetic nerve endings a specific nerve substance, that is, acetylcholin, is set free which likewise produces capillary dilatation. One may assume that carbon-dioxide sets free not only histamin, as Bornstein and Scheyner have reported, but also acetylcholin.

Now we are able to explain the distant-effect of the carbon-dioxide bath. Were its influence on the deeply situated vessels (for example, the renal vessels as evidenced by increased diuresis) to be considered only the result of the stimulation of autonomic nerve endings in the skin, then, according to our experience, the body would very soon grow accustomed to the stimulus and cease to react to it. I have repeatedly called attention to this in my writings. The contrary must be stated in regard to the formation of the histamin-like substance and acetylcholin in the skin, which is caused by the stimulus of the

carbon-dioxide in the skin. We cannot expect that the sensory nerves will become accustomed to such a chemical stimulus.

Effect of the Carbon-Dioxide Bath Upon Respiration

As already stated, Groedel I, in 1880, on the basis of experimental research, noted a change in respiration during the carbon-dioxide bath. This change was not the result of inspired carbon-dioxide, as many authors believe even today. According to our observations, confirmed by others, the carbon-dioxide content of the air lying over the water of the bath is barely increased. Moreover, the same physiologic effect of the bath is obtained when direct inhalation of gas is technically eliminated. The influence of the bath upon respiration must depend, then, upon either the diffusion through, or the retention of carbon-dioxide in the skin. That an increase of the circulating carbon-dioxide in the blood, as compared to normal, works upon the circulatory center we know to be true from both experimental and clinical study.

Recent experiments have gone still further into the question of respiration during the bath. Sarre found that in a bath the reserve air of the lungs is more or less expressed. Before the bath the lungs contain 2000-3500 cc. of air, but in the bath contain only 1500-2000 cc. The respiratory average line drops considerably. But since Schott and others have shown that during the bath the intra-thoracic pressure does not fall, but on the contrary increases 5 to 10 mm., one may conclude that the lungs during the bath are less compressed than is the thoracic cage. This may be the reason why, as Groedel I and later Wachter and myself observed, the depth of inspiration increases in the fresh water and in the carbon-dioxide bath. Liljestrand has expressed the same opinion, but Gollwitzer-Meier and her co-workers have had varied findings. The point at issue needs further investigation.

The alveolar carbon-dioxide tension shows similar reactions. It increases in cold, but diminishes in warm baths. Dauterbande has noted a contrary effect in the partial bath. In any event, the alveolar carbon-dioxide tension, according to Kramer, increases in the carbon-dioxide bath of neutral or indifferent temperature. The blood reaction in the carbon-dioxide bath leans therefore toward

the acid side.

It was pointed out above that certain important practical conclusions are to be drawn from the fact that in the full bath the intra-pleural pressure is increased. Therefore in decompensated hearts with pulmonary congestion, in which the intra-thoracic pressure is already increased and the elasticity of the lungs diminished, the hydrostatic pressure of the full bath has an ill effect upon the circulatory status. Accordingly one should give only half baths in such cases. Furthermore, the coronary circulation diminishes when there is an increase in intra-pleural pressure. So one must avoid full baths also in patients with a suspicious coronary condition. This is true likewise for patients with hypertension, for the reason that in the full bath the pressure in the jugular vein increases, corresponding to the level of the intra-pleural pressure.

Additional Observations

Further interesting data could be presented, but owing to lack of space only a few may be mentioned. One of the most important observations is the influence of the bath on the level of body temperature. In our earlier experiments we found that in a fresh water bath of neutral temperature the body temperature is lowered, at most 0.2 degree C. Whereas in the carbon-dioxide bath it is lowered 1.5 degrees C.

Ludolph Fischer was able to show in our Institute, by means of various ingenious methods, that the carbon-dioxide bath of neutral or indifferent tem-

perature has a tonic effect upon the vascular wall.

The results concerning changes in blood morphology, blood viscosity and blood chemistry are still not in accord. In spite of detailed experiments that I carried out with Metz, for example, we were unable to show a regular influence upon the blood sugar level, in contradistinction to their assertions of Arnoldi.

Although there are several unsolved problems, including changes in the electrocardiographic findings during the baths, detailed consideration will be given only to venous pressure determinations. As stated, the pressure in the jugular vein increases, but exact determinations are still wanting. According to my own unpublished experiments, as far as one may conclude from the phlebogram, the pressure amplitude increases in the sense of a thorough outflow and greater inflow.

Working Capacity of the Heart in the Carbon-Dioxide Bath

Studies of the effect of the bath on the circulatory apparatus have shown that as a result of the bath marked phenomena occur which imply a specific influence on the function of the cardiovascular system. The significance of these manifestations is still under discussion. We have yet to answer the question whether these factors are to be regarded as an indication of an increase in the working capacity of the heart, a diminished resistance against the work of the heart, or both.

Several publications in recent years have tried to solve this problem of the working capacity of the heart in the carbon-dioxide bath. Among their authors we may name Roenell, Bornstein, Budelmann and Roenell, Kroetz and Wachter. Exercising the utmost care and precaution in their experiments performed in our Institute, the last named authors have ascertained certain factors which briefly are:

- 1. In fresh water baths the minute volume increases but not to a great extent; an average of 20-24 per cent may be mentioned. In this, as in all the types of baths to be enumerated, there is a distinct individual variation to be observed in the reactions of the persons submitted to the experiments.
- 2. In the carbon-dioxide Nauheim Sprudel bath, one finds a slightly higher figure, averaging from 31 to 34 per cent.
- 3. In the oxygen bath the patient increases his minute volume on an average of only 12 to 18 per cent. Here again is proof that the oxygen bath is nearer the ordinary water bath than it is to the carbon-dioxide bath.
- In the carbon-dioxide gas bath one notices an increase of only 6 to 8 per cent.
 - 5. The air bath causes no reaction.

Experiments were also made at the same time to ascertain the time within which the minute volume returns to a normal level. In only a few instances did it remain increased for as long as 40 minutes after the carbon-dioxide salt bath — further evidence of the lasting effect of the natural carbon-dioxide bath.

Comparing these results with the reactions brought about by baths of various temperatures, the differences are very slight. In the cold water bath the minute volume does not markedly decrease, but in th warm water bath it increases 20 to 30 per cent.

The above findings show the values of the water bath of neutral or indifferent temperature and of the carbon-dioxide bath to be very similar. The increased working capacity of the heart in the carbon-dioxide bath is therefore in general not much greater than in the simple water bath. Individually, however, we find always that the carbon-dioxide bath increases the working capacity of the heart more than does the ordinary water bath.

Conclusions

The present status of physiologic experiments to determine the effect of carbon-dioxide water baths upon the circulatory apparatus may be summarized as follows:

The pulse rate diminishes. The blood pressure is usually reduced. The blood pressure amplitude is increased. The venous blood, as a result of the hydrostatic pressure of the bath, is shunted toward the heart. The intraabdominal, but still more the intrapleural pressure, is increased. The systolic working capacity of the heart is consequently improved. At the same time, through the plaxation of the muscles the arterial circulation is eased. The hydrostatic pressure and the carbon-dioxide stimulate the capillaries so that they become widened; more capillaries and arteriovenous anastomoses are opened, and these is an emptying of the deeply situated venous blood plexus, through which the circulation is ear d, the blood depots are emptied, and the temperature and water balance of the body are regulated. There is a distinct increase in the elimination of carbon-dioxide, which is continuous for a considerable length of time after the bath, without a corresponding increase in oxygen consumption, or, at most, only a very slight increase. The respiratory quotient in-

All of these phenomena are caused by the retention of carbon-dioxide in the skin and by its diffusion through the skin from the bath. The latter causes the skin cells to give off a histamin-like substance and acteylcholin. Each substance works not only locally but also stimulates the sensory nerves, thus affecting distant vascular systems. A further effect of the hydrostatic pressure is seen in the diminution of the average respiratory level of the lungs as a result of the compression of the boay thoracic cage. Simultaneously the respiratory depth becomes increased, as does also the alveolar carbon-dioxide tension. In any case the amount of circulating carbon-dioxide is increased. The increased carbon-dioxide which today we know, both clinically and experimentally, exerts an influence upon the circulatory centers, brings about an increase in the volume capacity and pressure capacity of the heart.

From what has been said, it is apparent that a great number of factors exert a definite local influence upon the vessels, especially upon the peripheral vessels, in the sense of producing a circulatory increase and circulatory lightening. Other factors are exemplified by the increased intrapleural pressure which directly stimulates the working capacity of the heart, and by still others which increase the circulating amount of carbon-dioxide with its intrinsic effect upon the circulatory centers.

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THE SARATOGA SPA

Its Place in the Treatment of Rheumatic Disorders *

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At the Twelfth Annual Session of this Congress, the author presented a review on "Balneotherapy in Circulatory Disorders." At the Saratoga Spa the treatment of these conditions is one of its major activities. Since the presentation of the paper three years ago, progress has been made in the development of the physical plant of the Saratoga Spa, with the addition of facilities to provide a better and more complete program of treatment. Two new bath houses with private rooms and equipment for special treatments, the Hall of Springs, providing for the use of the waters internally, a recreation unit including swimming, golf, and tennis, a new bottling plant with the latest equipment for bottling the waters in their natural state, and a hotel have been constructed. With these additional facilities Saratoga Spa offers an opportunity for pursuing a well rounded program of spa therapy in the treatment of various chronic conditions.

Among the patients coming to Saratoga for treatment, there are as many suffering from some rheumatic condition as those with circulatory disturbances. The rheumatic patient offers a challenge to the Spa to provide a proper course of treatment. Time does not permit a review of the large problems involved in the study and treatment of rheumatic disorders as a whole. It is only necessary to say that the American Association for the Study and Control of Rheumatic Diseases is making a detailed survey of this whole problem and their reports which are being published from time to time² are a distinct aid in the development of a program of treatment suitable in meeting these disabling conditions.

Etiologic Factors

In approaching the subject, it is understood that the author follows the classification used by the American Association. In referring to rheumatic conditions, he includes those affecting joint, muscle, nerve and connective tissues. In order to approach the problem of treatment of these disorders, a brief review of various etiological factors is indicated. Fox and Van Breemen³ discuss four causal factors:

- 1. Focal or other Infection.
- 2. Constitutional Anomalies.
- 3. Abnormal Conditions of the Skin.
- 4. External factors, such as Climate, Weather, Housing, Occupation, and Trauma.

The relation of infection to the development of these conditions has been widely stressed. Its place as the chief factor, however, is challenged by many students of these conditions. It is evident that some other factors must play a part because diseased tonsils in one person may lead to a serious attack of arthritis while in another person no such sequel results. The factor of infection should be considered in all patients and proper treatment initiated for its correction.

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 From the Medical Department of the Saratoga Spa.

Constitutional anomalies are much more difficult to define, but there is a growing feeling that they play a part, at least, in the development of rheumatic disorders. It is evident that certain patients suffer from repeated recurrent attacks of joint and muscle disturbances. The general make-up of one's nervous and mental constitution and their influence on the activity of the gastro-intestinal tract and circulation must be considered in the etiology.

The third factor, abnormal cutaneous conditions, has not received the attention that infection has attracted. In the study of patients with arthritis,4 the temperature of the skin exposed to low environment temperature has shown a greater drop than occurs in normal individuals. There is a diminished power to react to changes in the environment. Also, microscopic capillary studies5, 6 reveal in many patients a typical picture. The caliber of the capillaries is smaller, the course more tortuous and the number less than is found in the skin of a normal individual. The patient with rheumatic conditions frequently complains of itching and prickling sensations, and at times there is a distinct disturbance in the activity of the sweat glands. With the capillary disturbances, there are variations in the mechanism of heat regulation. The question arises as to whether these disturbances are secondary to the condition or bear an actual causal relation. The extensive studies of skin physiology, including the response to heat and cold and the configuration of the capillaries leads to the conclusion that these factors may in many patients be part of the abnormal constitutional make-up rather than a result of the disease. It would appear possible, with further studies of this type, to determine the individual who may develop this condition before the onset of arthritis, myositis and similar conditions.

The sensitivity of the rheumatic patient to climate and weather changes is well-known. This may well be a result of the abnormal skin condition. Time does not permit a consideration of the relation of occupation, trauma, and other external factors to this picture.

Therapeutic Program

In any therapeutic scheme for the management of these patients, a consideration of all the factors enumerated must be included, recognizing that these disorders involve the body as a whole, with local manifestations occurring in the joints, muscles, and connective tissues. The following outline is suggested in planning the treatment:

- A. Removal or treatment of infected foci, if located.
- B. Measures useful in the improvement of general physical condition.
 - 1. Rest.
 - a. Physical.
 - b. Mental.
 - 2. Dietary regulation.
 - a. Vitamins.
 - b. Minerals.
 - 1. Iron.
 - 2. Calcium.
 - 3. Proper elimination.
 - 4. Sunlight and artificial ultraviolet light.
 - 5. Tonic drugs.

- C. Measures useful in correction of abnormal skin responses.
 - 1. Baths.
 - a. Plain water.
 - b. Mineral water.
 - 1. Thermal.
 - 2. Sulphur waters.
 - 3. Carbon dioxide-containing waters.
 - 2. Sweating procedures.
 - 1. Hot body pack.
 - 2. Electric cabinet.
 - Hot air rooms.
 - 3. Air baths.
- D. Correction of external exciting factors.
 - 1. Change of climate.
 - a. Sojourn in another place.
 - b. Regulation of temperature and humidity in one's home—air conditioning.
 - c. Proper clothing.
 - 2 Change of occupation.
 - 3. Postural correction to remove repeated small traumata.
- E. Treatment of local manifestations.
 - 1. Local heat application.
 - a. Dry heat.
 - 1. Hot air.
 - 2. Radiant heat.
 - 3. Infra-red lamp.
 - b. Moist heat.
 - 1. Vapor and steam jets.
 - 2. Local baths.
 - 3. Hot water pack.
 - 4. Mud and fango packs.
 - 5. Whirlpool baths.
 - 2. Electrotherapy.
 - 3. Massage, movements and exercises, including pool treatment.
 - Orthopedic supportive and corrective measures including muscle training and pool exercises.
 - 5. Drugs to relieve pain.

Comment

Of this general therapeutic scheme I will discuss only those sections which may properly be provided at the Spa. The great importance of the proper treatment of foci of infection has been widely stressed. However, the removal of infected tonsils or diseased teeth does not end the responsibility of the physician in the management of these conditions.

General measures for the improvement of the patient's physical condition can well be carried out at the Spa. These include rest and relaxation both physical and mental. It is necessary particularly for patients with rheumatoid arthritis to give themselves entirely to the treatment which may mean hospitalization in the acute stage and a prolonged period of convalescence before return to active work. Rest can be obtained during the convalescent stages at a well organized Spa where hydrotherapy may be combined with it. In the dietary regulation of these patients the importance of an adequate well-

balanced diet has been emphasized. Vitamins and minerals, particularly iron and calcium, are added by many physicians. The general physical condition can be improved by particular attention to elimination through the intestinal tract. This elimination is aided at the Spa by the use of laxative mineral waters.

In the correction of abnormal skin conditions, physical measures play a major part, particularly hydrotherapy. As Currence' has shown, the regulated application of plain water baths followed by dry blanket packs is an effective measure in promoting elimination and improving the condition of many patients with arthritis. Stress has been laid on the merits of mineral waters. It is not my desire to enter into any discussion regarding the relative merits of the different types of mineral waters. Experience has shown that much can be done for the patient with the properly regulated use of baths in places where the waters differ widely in their constituents. Thermal waters, sulphur waters, and carbon dioxide-containing waters are all used in the treatment of these conditions. The carbon dioxide-containing waters have a distinct influence on the peripheral circulation, as is evidenced by the pronounced hyperemia and increased skin capillary circulation of patients following the baths. It is to be emphasized that with this type of water the improved circulation is obtained without the use of excessively hot baths, which in themselves may prove debilitating in many patients. This fact allows the use of these waters in a program aimed at the correction of abnormal skin conditions, as it has been shown that the capillary circulation may be defective in these patients.

Sweating procedures, including the hot dry body packs, electric cabinet and hot air rooms, have their place in meeting this problem. They permit the application of a higher degree of heat and are well tolerated by many of the patients with osteoarthritis, sciatica, and the like, where the general physical condition of the body will permit their use. The treatment of the skin by exposure to air, designated as air baths, also has its place in cutaneous training.

In the correction of external exciting factors the Spa offers an opportunity for a sojourn in another place with different climatic conditions from those at the patient's home. It is recognized that the change in climate to be effective may require a period of months or years, which is longer than the usual stay at the Spa. However, observation of the patient undergoing the Spa regime may give an indication whether or not change of climate may be effective. As a corollary, mention should be made of modern advances in air conditioning of homes as well as the need for proper clothing which will prevent sudden changes in the skin environment when the patient passes from warm to cold environment or vice versa.

In the treatment of local manifestations physical measures are important. The application of dry heat with hot air apparatus, radiant heat and infra-red lamp affords relief. In many patients moist heat is more effective in relieving pain than dry heat. It may be applied in the form of vapor and steam baths, local baths, hot wet packs, mud and fango packs, or whirlpool baths. All of these measures for the application of dry and moist heat are available in the well-equipped Spa. For the local condition movements and exercises, including exercise under water have their place. The importance of orthopedic supportive and corrective measures, including muscle training, cannot be neglected in this program.

In the application of hydrotherapeutic procedures, the reaction of the patient must be studied. It has been shown that there is a distinct difference in the response of the circulatory system, the nervous system, and the

metabolism, depending on whether the application is hot, tepid, or cold, and whether it is short or long. In general, very hot and very cold applications are stimulating to the circulation and the nervous system, particularly those of short duration. If continued longer they result in a poor reaction and do not accomplish any good. In the neutral temperature range the reaction is minimal to moderate and in general such procedures are better tolerated, particularly by the seriously ill. It is important, therefore, to study each patient so that the physical treatment may be properly regulated to produce a suitable reaction. This reaction may be incomplete or it may be excessive when proper regulation and application is not obtained.

Reactions During Treatment

In Spa treatment of these conditions two responses are not infrequently observed. Particularly in patients with poor vasomotor tone a lowering of the blood pressure, rapid pulse, faintness or syncope, may follow a too hot or too prolonged bath. When this is noted, it is an indication of over-treatment and care should be taken to prevent its recurrence either by the application of an ice water coil in the region of the heart and cold towels to the head or by a reduction in the temperature and duration of the bath. This reaction is more apt to occur in the patient with rheumatoid arthritis who frequently presents low blood pressure, secondary anemia and poor muscular and vascular tone. This reaction is to be avoided, as it only adds to the difficulty.

The second reaction is known as the "cure crisis." This is observed in some patients usually toward the end of the first week of treatment at a spa. The observers of this reaction differ in their opinions. Some believe the "cure crisis" is a good sign demonstrating the response of the patient to the waters and the treatments, while others consider that it is an indication of over-treatment. It usually manifests itself in the rheumatic patient by a slight increase in the symptoms associated with his condition. It gives the patient considerable concern, because he feels that there is a definite relapse. In many patients, however, this reaction is slight and transitory and the treatment may be continued with definite improvement. If this reaction is severe and the treatment is unduly pressed, the rheumatic process may be aggravated.

Saratoga Regime

The physicians at the Saratoga Spa make use of the natural facilities of the carbon dioxide waters and baths. Their internal use improves elimination through the intestinal tract and kidneys; their external use in the form of baths, usually given at temperatures varying from 95 to 100 degrees F. for 10 to 15 minutes, improves the activity of the skin, including its circulation and its response to external stimuli. Local treatment of the seriously affected parts, includes hot mineral water packs and mud packs. In addition, particularly in the osteoarthritic patient who may be overweight, eliminating treatment consisting of the electric cabinet, water and salt rubs and warm sprays and douches is used. Massage and exercises, both passive and active also are utilized in the treatment.

In this group of chronic conditions, as in circulatory conditions and disorders of the gastro-intestinal tract, the daily regulated program is important. The physician outlines the periods for rest and exercise, the time when the waters shall be taken, the type of baths and other external treatments. The importance of proper living accommodations, entertainment and relaxation must not be neglected. Wallace⁸ has recently outlined these auxiliary measures of spa treatment.

It requires years to evaluate clinical data regarding any program of treatment in chronic rheumatic conditions. The results observed from the program outlined above are noted in relief of pain, increased mobility, improved elimination and improved circulation, both general and in the skin. There also follows a better resistance on the part of the patient in his environmental conditions, as well as a distinctly improved mental attitude. It is well known that the will to get well and the cheerful mental make-up are large factors in the treatment of patients suffering from chronic conditions.

In meeting the important medical and social problems resulting from the widespread distribution of rheumatic disorders, the program as outlined by the American Association for the Study and Control of Rheumatic Diseases is to be recommended. Their recent appointment of a Committee to Study the American Spas should be an encouragement to those who are working out a well-regulated program for the spa treatment of these conditions. The development of more hospitals such as are found at Hot Springs, Arkansas, and at a number of the English Spas, where rheumatic patients can be studied and followed carefully during their treatments, is needed in this country.

Summary

Spa therapy offers to the rheumatic patient an opportunity for intensive treatment over a period of three to six weeks. The use of mineral waters internally and externally, and other forms of physical treatment, plays a distinct part in correcting many of the etiologic factors, particularly those affecting the skin, the intestinal tract and the nervous system. The change of environment, the opportunity to pursue treatments regularly and the application of measures for the improvement of the patient's general physical condition are all included in spa therapy, as part of any general program for the management of patients suffering from rheumatic diseases.

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FEVER TREATMENT BY STEAM (VAPOTHERMY) *

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From the dawn of history heat has been regarded as the natural panacea for pain. As an healing agent for many inflammatory diseases it has a deservedly high reputation. The Japanese have been pioneers in the use of intense hot water baths, with a temperature from 110 to 125 degrees F. as a therapeutic agent. Similarly for many years the Russians and Finns have employed steam or hot vapor, widely known and used in western countries as the Russian bath. The purpose of the application of great heat is to raise the temperature of the body locally or generally for the alleviation of suffering and the cure of disease.

Even before the time of von Jauregg the idea was conceived that in some way certain fevers were self-limiting and burned up the very poisons that started them. Von Jauregg was the first to recognize the efficiency of fever as a therapeutic agent in the treatment of paresis. Various other pathologic fevers, including typhoid and relapsing, have been used in dealing not only with paresis but also with other inflammations caused by microbic infection.

But the risk of life added to other disadvantages in prescribing a fever disease to cure disease, thus adding another morbid agent to an already sick

patient, was finally recognized and this has led to the use of various forms of heat for raising the normal temperature of the body to the fever stage. Within recent years artificial fever, aptly termed "friendly fever," has become a most useful and valuable agent for an increasing number of diseases, both acute and chronic. However, this form of treatment by electropyrexia is not simple nor innocuous, but one that requires skill and experience in selecting the patients and producing the fever so as to obtain the maximum benefit consistent with safety. Therefore it seems desirable to give careful attention to the type of apparatus used and the method of choice in inducing the fever, matters of great importance for both the physician and the patient. It is hardly necessary to add that the patient under treatment demands not only the closest possible supervision and observation, but that the physician and the attending nurse must possess special training in order to insure the maximum of safety and benefit. Furthermore, as McClure has pointed out, fever therapy is obviously not an office procedure and should only be given in a well-equipped institution where the patient is insured proper after care and is under direct medical control.

Vapothermy

After having used various methods for producing artificial fever, with very fair success for several years, Dr. Charles E. Stewart, of the Battle Creek Sanitarium, a year ago conceived the idea of using the old-fashioned steam bath as the heating agent. This suggestion appealed to us, and it is the purpose of this paper to describe briefly the apparatus and the method of administering the steam bath (vapothermy) for producing fever. All that is required is a suitable small chamber about 7 feet long, 5 feet wide and 6½ feet high, with a marble slab and a little window opening on a shelf for resting the head. This opening is fitted with a sliding shutter to prevent the escape of steam.

Into this already heated chamber the patient walks or, if necessary, is carried and is laid on the marble slab covered with a rubber mattress. For the

^{*} Read at the Fifteenth Annual Session of the American Congress of Physical Therapy, New York City, September 9, 1936.

purpose of checking the temperature a thermocouple is inserted into the rectum. The chamber is then closed, with the patient's head outside resting comfortably on a pillow. After the shutter is drawn down snugly around the neck more steam is turned on. Mouth temperature, pulse and respiration are recorded four times an hour by the attendant. The reading of the rectal thermocouple can be observed at any moment.

During treatment the patient is given several pints of water, lemonade and orange juice, to which a little salt has been added. Every 15 minutes the nurse enters the chamber and gives the patient a good rub which relieves nervous tension and brings ease and comfort. Fever treatment at the Sanitarium is always supervised by a physician, and a trained nurse is in constant attendance.

In the course of sixty to ninety minutes the temperature is gradually raised to the optimum degree required and maintained for the length of time desired. On leaving the cabinet the patient is wrapped in a sheet and blankets in order to reduce the temperature gradually.

Advantages of Vapothermy

Steam is a familiar and effective method of applying heat to the body. Many if not most of the patients who require fever therapy are acquainted with the steam bath from personal experience. Some have sat or lain on the benches and stewed in the hot, oppressive, close and often foul atmosphere until almost ready to collapse. To them there is nothing novel about the Russian bath and they enter the little chamber with confidence, free from any anticipation of danger, and they are pleased to know that the head will be entirely excluded from the stifling, hot vapor.

With the head in the fresh air, bathed with ice-cold compresses, fanned by a cooling breeze, and without restricting movement of the limbs, the patient obtains as much freedom and comfort as possible with a high fever. On the inside of a glass in the door hangs a thermometer showing the temperature in the chamber.

During the treatment the patient enjoys the maximum degree of safety and comfort consistent with its effects. Wrapping the patient in a sheet and blankets is, of course, unnecessary. Consequently, the limbs are free for movement. This feature alone appeals to the patients, many of whom seem to dread the restrictions and the close confinement that are associated with electropyrexia.

Under these circumstances the patient begins the treatment without apprehension, with confidence, and even with a degree of comfort. He is able to turn on the right or left side during the treatment, a freedom of movement that is usually appreciated.

A number of patients have a fear and even a dread of the electrical apparatus used for electropyrexia, anticipating the possibility of a burn, a severe shock or even the danger of electrocution. Nervous patients are naturally apprehensive and liable to imagine all sorts of possible dangerous experiences and happenings under the powerful electrical current.

With the possible exception of the hot water bath, which is not suitable for prolonged high fever, the vapotherm or steam bath is the most simple and safe method for applying sufficient heat to the body to produce hyperpyrexia. According to our experience most if not all of the patients find this type of fever treatment not only unconfining, but also the most tolerable and least unpleasant.

With the same length of exposure and the same degree of fever the patient suffers the minimum of discomfort and prostration and afterwards makes a prompt recovery, followed by a good night's sleep. The entire procedure is so simple and so easily understood and followed that it is entirely free from complications. It seems strange that a method which is so inexpensive, easy

to control and yet efficient, has been overlooked. We are not aware of anyone using this old-fashioned and widely known form of plain hot steam bath for artificial fever.

As regards the physiologic effects they are naturally much the same as in other fever procedures but accompanied by less misgiving, less nervous strain and suffering for the patient. At least this seems to be the consensus of opinion of those who have had the treatment. To us the application of external heat seems a more natural and more perfectly controlled mode of attack than the penetrating type, but we recognize there is diversity of opinion on this question. For these and other reasons we do not hesitate to recommend vapothermy as a convenient, simple, inexpensive and successful method of pyreto-

We repeat that a small room provided with the necessary steam pipes, a table and window for the head, and a thermocouple are all the apparatus required. It is but little more oppressive or distressing given in this way than the old-fashioned steam bath, when the patient was entirely confined to the room and obliged to breathe the heavy, hot, stifling, moist air.

Discussion

Dr. Heinrich Wolf (New York): The difficulty in all physiologic experimentation on the circulatory system in the course of hydrotherapeutic procedures lies in the many variables which have to be considered. This is not only the anbe considered. This is not only the an-tagonism of the peripheral circulation, skin and the vessels in the extremities, and the internal vessels, the arteries and the inner organs, kidneys, liver, and spleen, but also the influence of the unstriped muscles of the skin and the antagnostic action of the vessels of the brain and even the tonus of the individual or-In experiments made with Strasser we showed that cold applications to the skin produce contraction of the kidney and spleen, but when a kidney is not handled gently it losses its tone and the results of cold stimulations are reversed, the kidney dilating under the increased blood pressure.

The antagonism between the peripheral and inner circulation on the one hand and the brain on the other is best demon-strated by the fact that cold applications to the fect and other parts of the skin have such an excellent influence on cer-tain forms of headaches. This effect has a biologic basis. The brain is being well supplied, particularly under stimuli to the periphery.

I have spoken of the part the unstriped skin muscles play in the circulation. experiments have clearly shown that there is an independent, automatic control of these muscles, which explains the in-creased turgor after short cold applica-tions in spite of the dilatation of the skin capillaries and the decrease in volume even with skin hyperemia. This is a even with skin hyperemia. This is a fact which may, well explain the failure of contrast baths in severe diseases of the peripheral circulation, such as thrombo-angiitis obliterans. In these cases the capillaries cannot dilate or cannot be supplied with additional blood while the skin muscles contract, adding to the difficulties of the circulation. I should also like to

elucidate a passage in the paper of Dr. Behrend.* Cold applications after hot baths are certainly unnecessary but it baths are certainly uniference seems to be advisable to use them after lukewarm applications. For instance after wet packs the skin becomes very sensitive to any change in temperatures and colds may easily develop.

Permit me to add one more word about the laws in physiologic ex-perimentation. Modern science sees in natural laws only abstractions. In physiologic experiments we have to deal with so many variables that it becomes impossible to establish an ex-act basis; too many factors would have to be temporarily disregarded. This is the reason why the results of experiments and the opinions of experts differ We will have to be somewhat less em-phatic therefore, and take all the facts into account.

This applies also to the experiments and ideas of Hauffe. He is an iconoclast. For instance he completely disregards the action of the skin muscles Win-ternitz has shown long ago that cold applications to any part of the body cause a contraction of the vessels in the entire skin area. Strassburger and many others have shown that hot applications constitute as much of a stimulus as the cold baths. I cannot here go into his new conception of circulation. His demonstration that a local hot bath may have a curative effect on distant parts is a val-

uable contribution, an experience which Fox has used systematically.

The production of fever by the method described by Dr. Olsen has certainly the advantage that burns are impossible. This method, however, can only be used economically in institutions such as the one with which Dr. Olsen as the one with which Dr. Olsen is connected. Few hospitals would be inclined to establish such a department.

^{*} Article by Dr. Hans Behrend was published in the March, 1937, issue of the Aschives. Ed.

EVALUATION OF ROENTGEN RAYS IN THE TREATMENT OF CHRONIC NOSE AND THROAT INFECTIONS *

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During the winter of 1935 and 1936, The Metropolitan Life Insurance Company took one-half a page of space in one of our popular lay magazines for the purpose of calling to the attention of the public the importance of "Health Enemy No. I....... the Common Cold." "Look out," they pointed out, "for the common cold." "Last year it cost more than 500 million dollars in wages, caused more absence from work than any other sickness, robbed millions of children from time at school." There the care of the acute cold and its complications was stressed and here it is the privilege of your essayist to discuss with you a rather new method of treatment of some of the complications or results of "colds."

The use of the roentgen rays in the treatment of chronic focal infections of the nose and throat is not exactly a new procedure. However, the profession to date has not had its attention called emphatically enough to this valuable method of treatment. Fifteen years of experience has convinced me that in the vast majority of cases the roentgen ray method of treating chronic focal infection of the throat, namely, tonsils, adenoids, and nasopharyngitis, is not only safe and permanent, but will more thoroughly and completely remove this infection than any other method yet devised, surgical or otherwise, and furthermore, the contraindications to operation need not be feared with this procedure.

Principle of the Treatment

Lymphatic and embryonic structures are more radio-sensitive, therefore more easily destroyed by roentgen days than any other living tissue. The tonsil is composed mainly of lymph tissue. The small fibrotic tonsil, so commonly found in cases of rheumatism, contain lymph structures, the larger portion of which is embyronic tissue. Hence, it is necessary to use only very small doses of roentgen rays to cause the absorption of the lymphatic elements of the tonsil which will not in any way damage the normal structures that are irradiated.

From the standpoint of infection, the shrinkage of the tonsil and lymphatic structures of the wall of the throat by roentgen ray treatment will produce drainage and relieve the deformity throughout the entire mucus membrane which is impossible by any operative treatment available today. Because of these effects, roentgen ray treatment is our best method of eradicating some of the most dangerous throat infections, that is, those due to hemolytic streptococcus and staphylococcus, and therefore if the treatment is given, many lives are saved.

Results

From 80 to 90 per cent of those suffering with recurrent attacks of tonsillitis, nasopharyngitis, and laryngitis have been relieved by roentgen ray treatments. The enlarged tonsil gradually recedes until it disappears be-

^{*} Read at the Fifteenth Annual Session of the American Congress of Physical Therapy, New York City, September 8, 1936.

tween the pillars and the crypts empty themselves and become normal. Islands of infected lymphoid vissue, together with the angry redness of the nasopharynx, disappears with this method of treatment. Almost always, whenever one's tonsils are diseased, the nasopharynx and the lymphoid tissue about the base of the tongue are also infected. Removal of the tonsil in such a case will not go far in the cure of such a patient, particularly when the tonsils have been removed for the cure of some malady in another part of the body thought to be due to a focal infection of the throat. But with roentgen therapy, the infection is completely cleared up. As has already been stated, the tonsils after treatment cannot be seen without retracting the anterior pillars. The mucus membrane of the tonsils, together with the infected tissue of the infected nasopharynx, is smooth and has a normal, healthy, pink color instead of a fiery red. The fact that the entire throat is cleared of chronic infection is probably the reason why so many patients who have had their tonsils removed do not experience relief until they have been thoroughly and properly irradiated.

In addition to clearing up the results of infection of the throat with the roentgen rays, many cases with histories of having had one "head cold" after the other with repeated attacks of "sore throat," have been entirely relieved of this distressing state of affairs. Chronic sinusitis, with post-nasal dripping often give perfect end results. Not a few cases of middle ear deafness have been improved by roentgen ray treatments. Cases of mastoiditis which have resisted healing following operation, have responded to roentgen treatments. In many cases of rheumatism, arthritis, and neuritis, when the cause is traced to focal infection within the throat, the results of roentgen treatments in relieving pains, aches, and stiffness finds no equal in any other method of treatment.

Complications Resulting From Treatment

The roentgen ray method of treatment, as compared with the surgical removal of tonsils, is carried out without any complications. When the tonsils are removed surgically, one may have any or all of the complications resulting from septic particles of matter which are thrown into the circulation; heart disease, hemorrhage, middle ear infection, mastoiditis, lung abscess, etc. In the roentgen ray method of treatment there are, of course, no complications whatever, providing all the details of the treatments are executed by one who has been properly and thoroughly trained. The safety of the method, as well as the permanency of results, can be checked by anyone who has been engaged in this work for ten or more years. My own tonsils were treated fifteen years ago with perfect results. The results obtained in my own case led then to the treatment of each and every member of my own family. Then several physicians were treated, some of whom were nose and throat specialists, and since, several hundred patients have been treated.

More than half the total total number of these patients had already had from one to several nose and throat operations, with little or no relief from their complaints. The results obtained in the vast majority of these cases is but further proof of the real value of the roentgen ray method of treatment. It finds special indication in stars of the opera and other vocalists, since injury to the throat is reduced to a minimum as compared with the surgical tonsil removal. The method is also indicated in patients who are too ill from other causes or otherwise poor surgical risks.

PHYSICAL AGENTS IN RELATION TO THE TREATMENT OF NASAL SINUSITIS *

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We are all undoubtedly aware of the fact that a wide variation of opinion exists as to the effects of the various physical agencies when used in the treatment of infections of the nasal sinuses. A short time ago the writer took the trouble to review the literature and was able to find nothing on this particular subject. Considerable work had been done, however, on the penetration of heat into various more solid structures, such as the orbit, etc.

Moncreiff, Coulter and Holmquest¹ found that the penetration of heat into the orbit is greater with infra-red rays than with an electric heating pad. They expressed the opinion that the ability of the skin to tolerate heat largely determines the amount which penetrates beyond it. An additional 2 C. was tolerated by the skin when irradiated by infra-red rays than when the electric heating pad was used.

Cone² made some readings for the temperature of the mucous membranes of the nasal passages. He found the temperature higher in patients with infection of the sinuses and in those whose basal metabolism was above normal. The temperature was lower when the metabolism rate was low and when allergy existed.

Krukower³ found that the temperature of the body influences the temperature of the sinuses to a slight degree, while the temperature of the outside air was very little, if any, effect. He also found that the temperature of the membranes is increased in the presence of acute and subacute infections but is not altered in the presence of chronic infection.

Lewis and Pickering⁴ found that raising the temperature of the body causes vasodilatation of the blood vessels of the extremities when these are exposed to the outside temperature while the remainder of the body is being warmed in a cabinet. They expressed the opinion that this is the means the body employs to dissipate abnormally high temperatures in isolated portions of the body.

Materials and Apparatus

Plans were made to record the changes in the temperature of the sinuses when cold compresses, an icebag, a hot water bottle, a lamp radiating infrared rays or hot compresses were applied to the region over the sinuses or when the whole head was, heated by the high frequency oscillating current.

Apparatus Used to Apply Heat and Cold

Small bath towels wrung out of ice-water were used for cold compresses. The ordinary commercial rubber bag filled with cracked ice was used for the icebag. Small bath towels wrung out of boiling water and applied to the face as soon as the skin could tolerate them were used as hot compresses. The electric heating pad was a rubber-covered heating unit, operating at 115 volts and 0.1 ampere, with a cloth outside cover. The lamp had a 260 watt bulb, with a carbon filament. The reflector was polished metal and was 7¼ inches (19.69 cm.) in diameter, and the lamp was set so that the

^{*} Read at the Fifteenth Annual Session of the American Congress of Physical Therapy, New York City, September 8, 1936.

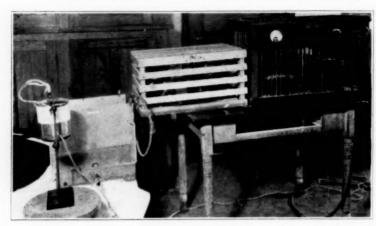


Fig. 1. — The apparatus set up for use, with the patient's head between the plates. The cold junction of the thermopile is in the foreground at the left, and the oscillator and transformer are in the middle and in the foreground to the right, respectively.

rays would strike the cheek at right angles at a distance of 18 inches (45.7 cm.) from the bulb to the skin.

The high frequency oscillator used in these experiments was constructed on the same principle as a short wave radio transmitter, with the exception that the energy was concentrated between two condenser plates instead of being directed from an aerial. The heater was designed by the General Electric Company and consisted of a vacuum tube oscillator and rectifier that supplied the high voltage from the oscillator. The high frequency oscillator was composed of two 75 watt radiotrons operating at a frequency of from 9,000 to 12,000 kilocycles. An air-cooled transformer, having a 4,500 volt secondary rectifier and feeding a full wave rectifier, formed the 2,000 volt supply of direct current to the plate of the oscillator. The patient's head was placed between these places, almost filling the space of 16 inches (40.6 cm.) between them. Figure 1 shows the apparatus set up, and figure 2 shows details of the hook-up.

Apparatus Used to Record Changes of Temperature

To record the changes of temperature within the sinuses, a thermopile of four junctions, each consisting of a strand of No. 20 constantan and No. 30 iron wire, was used. Each junction was electrically welded, and copper wires connected the terminals of the thermopile with the registering galvanometer. The resistance of the whole assembly was found to be about 21 ohms. The individual wires were given three coats of flexible waterproof enamel and were made into a single cable by tying them together with fine silk thread.

The cold junctions were immersed in about 5 cc. of 95 per cent alcohol contained in a small tube, which was in turn inserted through a rubber stopper. This was fitted to the top of a thermos flask filled with finely crushed ice. The flask was wrapped in vegetable wool and placed in a metal can with only the neck of the flask protruding.

The thermo-electric voltage generated by this sensitive thermopile was found to be so great that the readings on the mirror galvanometer were pushed entirely off the scale. It was therefore necessary to bring the readings back on the scale by the application of an opposing voltage in the thermopile circuit. This current was adjusted by interposing several variable resistance units. Figure 3 shows the recording apparatus, and figure 4 shows the hook-up.

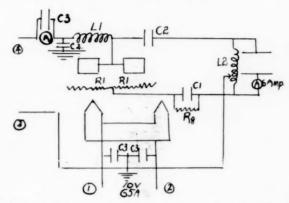


Fig. 2.—Diagram of the wiring of the 30 meter oscillator equipped with two UX 852 tubes. Al indicates 0.6 amperes full scale deflection thermocouple ammeter, type Do6; A2, 0.500 milliamperes full scale deflection ammeter, type Do4; L1, chock coil; L2, 8-turn coil copper wire, ½ by ½ inch (0.64 by 0.8 cm.); C1, 0.002 microfarad capacity condenser UC 1014 or 1874K; C2, condenser UC2224; C3, Faradon model T condenser, 0.01 microfarad capacity; Rg, large blue sticks, resistance 10,000 ohms, and R1, resistance, 10 volts, 6.5 amperes.

The thermopile was calibrated by comparison with a thermometer graduated to 0.2 F. The tip of the thermopile was loosely fastened to the bulb of the thermometer, which was immersed in water kept in constant motion by an electric stirring apparatus. Several hundred readings were made at intervals of 0.2 F. from 106 to 96 F. It was found that 1 F. averaged from 1.87 large divisions on the galvanometer. As each large division on the galvanometer was graduated into tenths, the instrument could be read directly to about one-nineteenth of a degree Fahrenheit. The original aim in the design of the apparatus was an accuracy of 0.1 F. The surplus sensitivity merely reduced the average error. A series of readings by different observers indicated that the variations on the galvanometer per degree of change of temperature were practically the same within the limits to which the thermometer could be read and that the temperatures could be read directly from the galvanometer as equal divisions of the deflection between two end-temperatures without calibration for each intermediate interval. Before and after each experiment the thermopile was checked in water of known temperature to insure accuracy.

In several of the experiments in which the stem of the thermopile cable was directly exposed to heat or cold from the apparatus the stem was protected by several layers of thin leather. Control tests proved that heat applied to the stem of the thermopile had no effect on the reading of the instrument.

When the high frequency oscillator was used to heat the subject's head it was found that currents induced in the galvanometer circuit seriously interfered with the readings for temperature if the oscillator was close to the registering apparatus. It was necessary to move the oscillator about 50 feet (1,524 cm.) away before this difficulty was overcome. When this apparatus was used in the experiments the thermopile was placed in the patient's sinus and allowed to remain there until the readings became stabilized. It was then removed while the oscillator was in operation and was quickly replaced after the current was shut off.

When the tip of the thermopile did not completely fill the opening into the various sinuses the remaining opening was completely closed by a cotton packing.

Subjects Used

When the work was first planned I intended to use animals. Later it

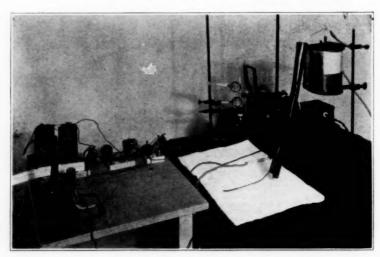


Fig. 3.—The recording apparatus, showing the gaivanometer, resistance units, water bath with thermometer for checking readings, electric mixer and thermopile protected by a leather covering, with the cold function of the thermopile in the thermos jar.

was thought that the results might have a more practical value if the experiments were carried out on human subjects.

Three patients were used in the experiments to be described.

Patient A was a youth, aged 18, who weighed about 150 pounds (68 kg.) and had bacterial asthma of fourteen years' duration. The septum had been resected, the antrums had been ventilated, a complete ethmoidectomy had been performed, and the anterior wall of the sphenoid sinus had been partially removed. The nose was clean, but the membranes were thickened.

Patient B was a woman, aged 22, who weighed about 125 pounds (56.7 kg.) and had asthma of ten years' duration. She had had the same operations as those mentioned by patient A. The nose was clean, and the membranes slightly thickened.

Patient C was a man, aged 52, who weighed 150 pounds and had had asthma about twelve years. He had had the same operations as those performed on patients A and B, except that the sphenoid sinus was not opened.

None of these patients had any evidence of acute infection of the sinuses when the tests were made. Each was the subject for numerous experiments over a period of two years.

Experimental Observations

Experiment 1 (patient A). — The thermopile was placed in the right nostril. The temperature registered 92.6 F. The thermopile was then placed in the left nostril, and the temperature registered 90 F. On inspiration the temperature was about 2 F. lower than on expiration. When the thermopile was removed the right nostril appeared to be somewhat obstructed as compared with the left nostril.

Experiment 2 (patient A; icebag). — The thermopile was placed in the right antrum. When the galvanometer readings became stabilized, in fifteen minutes, an icebag was placed on the face in the region of the right antrum. This was left in place for one hour. No definite change in the readings was recorded.

Experiment 3 (patient A; cold compresses). — The thermopile was placed in the left antrum. When the galvanometer readings became stabilized, in fifteen minutes, cold compresses wrung out of ice-water were

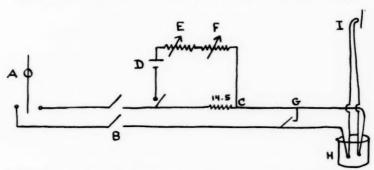


Fig. 4.— The details of the recording apparatus, showing A, galvanometer; B, switch; C, resistance unit; D, batteries; E and F, resistance units; G, switch to short circuit the thermopile, and I, the tip of the thermopile.

placed on the region of the left antrum, and were changed as they warmed, for a period of one hour. No definite changes in the readings were recorded.

Experiment 4 (patient A; hot water bottle). — The thermopile was placed in the left antrum. When the galvanometer readings became stabilized, after fifteen minutes, a hot water bottle was placed on the region of the left antrum. This remained in place for one hour. No definite changes in the readings were recorded.

Experiment 5 (patient A; electric heating pad). — The thermopile was placed in the right antrum. When the galvanometer readings became stabilized, after fifteen minutes, the electric heating pad was placed on the region of the right antrum and the switch was turned to the high position. The pad remained in place for one hour. No definite changes in the readings were recorded.

Experiment 6 (patient A; hot compresses). — The thermopile was placed in the left antrum. After the readings were stabilized, in fifteen minutes, compresses wrung out of boiling water were applied to the region of the left antrum as soon as the skin would tolerate them. These were changed every five minutes, as they cooled, for a period of one hour. No definite changes of temperature were recorded.

Experiment 7 (patient A; radiant heat). — The thermopile was placed in the right antrum. The window was not closed with cotton. After the readings were stabilized, in fifteen minutes, the lamp was put into the position described before. The lead and the exposed portion of the thermopile were protected by several layers of leather.

After the heat had been on for twenty-two minutes, the temperature of the antrum began to drop. At the end of one-half hour the temperature had dropped 1.4 F.

After the heat had been on about twelve minutes, the patient noted an increase of drainage from the nose. When it was expelled it appeared to be serous.

Experiment 8 (patient B; radiant heat). — The thermopile was placed in the right antrum. In fifteen minutes the readings for temperature had become stabilized at 93:15 F. The heat was applied in the usual manner. After one-half hour the heat was turned off; the temperature had dropped 1.03 F. The readings were continued with the heat off. The temperature continued to drop, and in eight more minutes it had fallen an additional 0.96 F., making a total fall of 1.99 F. It then began to rise slowly.

It was necessary to remove the thermopile at this time on account of the fatigue of the patient.

Experiment 9 (patient B; radiant heat). — The thermopile was placed in the left antrum. After eighteen minutes, when the readings for tem-

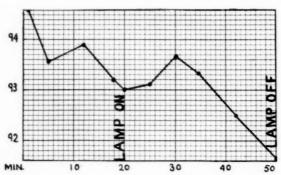


Fig. 5 (patient A). — Graph showing the observations in experiment 7. In this and the following graphs the figures along the left-hand margin refer to degrees of temperature.

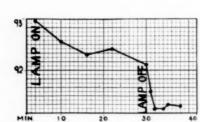


Fig. 6 (patient B). — Graph showing the observations in Experiment 8.

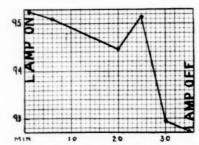


Fig. 7 (Patient B). — Graph showing the observations in Experiment 9.

perature had become stabilized, the heat was directed in the usual manner to the region of the left antrum. After thirty-five minutes the temperature had dropped 2.53 F.

Experiment 10 (patient A; radiant heat). — The thermopile was placed in the left antrum. After twenty-one minutes, when the readings for temperature had become stabilized, the heat was directed in the usual manner. After the heat had been on for twenty minutes, the patient had a severe paroxysm of coughing, and the thermopile was removed. The patient began to have a moderate amount of dyspnea, and the experiment could not be continued. In the twenty minutes during which the heat was on there was a drop of 0.5 F. The following morning the patient had a rather severe attack of asthma and was compelled to remain at home for eight days.

The patient's nose was examined before this experiment was begun, and no sign of acute inflammation was noted. The temperature by mouth before, during and after the experiment was 98.4 F. The fact that there was only a limited drop in the temperature during this test might be accounted for by the fact that the patient was obviously on the verge of an acute infection of the upper respiratory tract.

Experiment 11 (patient A; radiant heat). — The thermopile was placed in the left sphenoid sinus. In fifteen minutes the readings for temperature were well stabilized at 96.48 F. The heat was directed to the left side of the face. The temperature began to drop slowly for thirty-six minutes, when it read 94.65 F., a drop of 1.83 F. It then began to rise slowly, and after another thirty minutes it had risen to 95.42 F., a rise of 0.77 F. It was still 1.06 F. below the original reading.

This drop occasioned considerable surprise, as it was entirely unexpected. The thermopile was immediately recalibrated, and the readings were found to be correct.

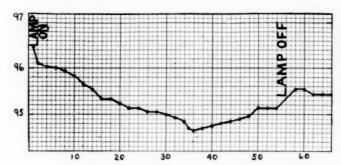


Fig. 8 (patient A). Graph showing the observations in Experiment 11.

A moderate amount of muco-serous discharge was expelled from the nose.

Experiment 12 (patient B; high frequency oscillator). — The thermopile was placed in the right antrum. It was allowed to remain there for fourteen minutes, until the temperature became stabilized at 93.85 F. The thermopile was then removed, and the oscillator was turned on. After being on for thirty minutes it was turned off, and the thermopile was quickly replaced in the right antrum.

When the readings became constant the temperature registered 92.66 F. It remained there for several minutes and then began to hise. At the end of ten minutes the temperature had returned to the original reading of 93.85 F. This was a drop of 1.19 F. after thirty minutes' exposure to the high frequency field.

The general reaction was very mild. No sweating was noted, and there was only a moderate amount of nasal discharge as compared to the profuse secretion caused by the radiant heat.

Experiment 13 (patient A; high frequency oscillator). — The thermopile was inserted in the left antrum. In twelve minutes the temperature registered 93.14 F., and remained stable at that point. The thermopile was removed and the oscillator was turned on for thirty minutes. The thermopile was replaced in the left antrum. The indicator of the galvanometer went off the scale to the right, or red side, and would not return. The thermopile was left in the antrum for fifteen minutes, but there was no registration of temperature. It was removed from the antrum and recalibrated. There was a drop of five and one-half full divisions in the calibrations. Search was made for the difficulty and a short circuit was found in the thermopile. The result of this experiment could not be determined. A reserve thermopile was used in the subsequent experiments, after many calibrations.

Experiment 14 (patient C; high frequency oscillator). — The thermopile was placed in the right antrum. After fourteen minutes the temperature was stabilized at 97.86 F. The thermopile was withdrawn, and the oscillator was turned on. After running for fifty-four minutes, the current was shut off, and the thermopile was quickly reinserted in the right antrum. The temperature registered 96.7 F., a drop of 1.16 F.

Experiment 15 (patient A; high frequency oscillator). — The thermopile was placed in the left sphenoid sinus. After ten minutes the temperature had stabilized. The thermopile was removed, and the oscillator was turned on. After thirty minutes, the current was turned off, and the thermopile was replaced in the left sphenoid sinus. No change in the temperature was noted. The patient felt no sense of general warmth, and the nasal secretion was very slightly increased.

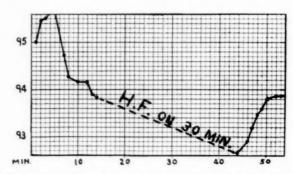


Fig. 9 (patient B). - Graph showing the observations in Experiment 12.

Comment

It appears from the experiments described that cold derived from ice compresses and an icebag and heat derived from hot compresses, a hot water bottle and an electric pad have essentially no effect on the temperature of the sinuses when these agents are applied to the face. They do not appear to increase the nasal secretions perceptibly or to increase the moisture on the skin by sweating. On the other hand, the heat derived from the high frequency oscillating current and from the lamp used in these experiments apparently does cause a drop in the temperature within the sinuses and an increase in the production of sweat on the cutaneous surfaces. This is particularly true of the radiant heat. None of the agents used caused a rise in the body temperature.

It was not a surprise to find that certain of these agents did not cause a definite reaction, but it was a great surprise to see the temperature fall when the other agents were used. It was anticipated that the infra-red rays and the high frequency current would undoubtedly increase the temperature within the sinuses, for there is ample experimental evidence to prove that heat from these agents does penetrate solid structures. Why, then, did it cause exactly the reverse to happen in the sinuses? It has been pointed out in this paper that an increase in the nasal secretions accompanied the use of the infra-red rays and the oscillating current. These are the two agents which cause a drop in the temperature. Does it not seem reasonable to assume that the loss of heat in these instances was due to the evaporation of an increased quantity of moisture? When the body is heated above a normal temperature the cutaneous surfaces are moistened by sweat. Is it not a well known fact that the respiratory tract also aids in the regulation of the temperature of the body by the dissipation of heat from its moist surface? This is particularly true in the dog and in other animals which depend almost entirely on this mechanism for the reduction of temperatures above normal. When all these facts are considered it does not seem so strange that the temperature within the sinuses should drop when certain forms of heat are applied to the face. It appears, then, that this phenomenon is apparently a part of the mechanism involved normally in the regulation of the temperature of the body.

It is not contended that heat from the lamp and from the high frequency oscillator actually reaches the membranes lining the sinuses, although there is a possibility that it does, for the same phenomenon might easily occur if the soft tissues external to the sinuses were heated and a portion of the excessive heat was dissipated from the body by way of the respiratory tract.

What about the practical application of these findings? Does it neces-



Fig. 10 (patient C). - Graph showing the observations in Experiment 14.

sarily follow that because the temperature dropped when the lamp and the oscillator were used that these agents have no value in the treatment of the sinuses? It is my opinion that these two agents are of great value in the treatment of acute and subacute infections of the sinuses, for it has been shown that there is a definite increase of thin serous discharge from the nose and sinuses when they are used. This obviously improves the drainage and hence hastens resolution.

The writer has taken advantage of these facts in the treatment of acute infections of the sinuses and of the middle ear and mastoids. Time and time again I have seen these agencies cause an increase in the serous discharge and a definite decrease in the temperature, pain and swelling. The use of these agents has enabled me to modify my treatment of these conditions very materially. It has rarely been necessary to wash out the sinuses and many mastoids which otherwise would have been operated upon have been healed by this more conservative treatment.

When cold is applied to these areas under these conditions the pain is often relieved and some swelling is reduced but I do not believe that healing is promoted thereby. It is my opinion that the relief is probably subjective.

I certainly do not believe that the expression of these opinions is going to cause many of you to change your treatment of these conditions, but I do hope that you will give the method a fair trial. If you do, I am confident that you will be amply rewarded for your efforts.

Summary

Cold compresses, an icebag, hot compresses, a hot water bottle, an electric heating pad and a lamp for the radiation of infra-red rays were used to apply heat to the face in the region over the sinuses, and the whole head was heated in the field of a high frequency oscillating current of from 9,000 to 12,000 kilocycles.

Readings of the changes of temperature within the maxillary and sphenoid sinuses were made.

No changes in the temperature were noted when ice compresses, an icebag, a hot water bottle, an electric heating pad or hot compresses were used.

A drop of 1 to 2 F, in the temperature of these sinuses occurred when the infra-red rays and the high frequency oscillating current were used. This drop was unexpected, but it was accounted for by the evaporation of the increased nasal secretions which accompanied the use of these agents.

The relative therapeutic value of these agents in the treatment of disease of the sinuses is discussed.

240 State Street.

(Concluded on page 494)

TREATMENT OF SINUS INFECTION BY ULTRA SHORT WAVE DIATHERMY*

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and

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PHILADELPHIA

The treatment of acute and chronic sinusitis is a problem which has taxed the ingenuity of the medical profession and has been the subject of much discussion in the medical literature of recent years. When one stops to consider the numerous symptoms which arise from the absorption of toxic products in sinus infections, and the frequency with which these infections act as the focal point of metastatic disease, it is quite clear that the subject deserves very careful consideration.

The normal healthy sinus is lined with mucous membrane, on the surface of which is the ciliated epithelium. The normal movement of these cilia aid in draining the sinus and ridding it of normal and abnormal secretion. As long as the natural openings of the sinus are intact and functioning, the sinus can drain normally and maintain a healthy mucous membrane.

Infection of the sinuses usually results from the spread of an acute inflammatory process of the nasal cavity. Inflammation of the sinus results in hyperaemia with increased nutrition and an increased flow of leucocytes to the part. A natural result of this is swelling of the mucous membrane, which in itself frequently closes the natural opening and dams back the secretions. After an inflammation of this type persists for a period of time, it gradually merges into the chronic stage. Here we still have a slight hyperaemia with swelling of the mucous membrane and round cell infiltration. Later there develops a proliferation of connective tissue, resulting in thickening of the mucous membrane and interference with the drainage of the cavity. In addition, the ciliated epithelium is destroyed, causing the loss of activity of the cilia and still further interfering with the proper drainage of the cavity. Occasionally, the edematous swelling of the mucous membrane passes on to the stage of polypoid degeneration. When the drainage and ventilation of the mucous membrane lined cavity is interfered with or blocked, conditions are favorable for the growth of pathogenic bacteria.

In the chronic stages, this blockage is incomplete but prevents the natural recovery of the mucous membrane and permits a certain activity of the pathogenic bacteria. The symptoms resulting from absorption of toxic products from the sinus are varied. The most common symptom is headache, which is frequently intermittent in character and is increased as the drainage of the sinus is progressively blocked. The location of the pain will depend upon the sinus most involved. Crusting occurs in the nose and a post-nasal drip is a fairly constant symptom. Loss of the sense of smell occurs and the condition is often associated with a very disagreeable odor. Eye symptoms are frequent and as a result of the systemic absorption, we find many general symptoms such as mental depression, dizziness and lassitude.

In chronic cases, the drainage is usually sufficient to permit a gradual discharge of secretions, especially from the ethmoids and antrum, and there can frequently be considerable infection present without pain. As a result of the absence of this symptom, infection may be present in the antrum and ethmoids

^{*} Read at the Fifteenth Annual Session of the American Congress of Physical Therapy, New York City, September 8, 1936.

without the patient's knowledge. As a consequence, there is often a long delay in seeking medical attention. When the frontal sinuses become involved, pain is more common and the patient quickly seeks relief. Chronic sinus infection tends to persist indefinitely.

The intimate association of sinus infection with secondary pulmonary involvement, such as bronchiectasis, is a well known occurrence, and has been amply demonstrated from various angles, particularly by means of the x-ray. This is most important in the young, where irreparable damage can be produced in the lungs.

It cannot be denied that surgery plays an important part in the treatment of sinus infection, particularly where, through anatomical defects of malformation of bone, there has resulted a condition which prevents adequate drainage of the sinuses due to obstruction of the natural openings. Neither can it be denied that surgery is frequently employed inadvisedly. Nowhere in the body is it so important that the surgeon possess more than the average skill and dexterity to secure proper drainage. MacKenzie, in his text-book on diseases of the nose, throat and ear, states: "I am compelled to admit that the surgical treatment of chronic nasal sinus disease is often disappointing." Is it any wonder, therefore, that with the many poorly trained nasal surgeons, much surgery is performed without giving free drainage? Expert opinion has varied constantly during the last twenty years as to the value of surgery, mainly because of the lack of skill of so many men who attempt this type of work.

An early surgical approach is a mistake. Surgery should be undertaken only after a careful analysis of all the factors in the case, and even then should only follow the careful trial of conservative methods. Daily irrigation of the antrum will not always cure the disease, and in the presence of acute fever, manipulation of any sort may be dangerous. It should be remembered that no operation should exceed in risk the disease which it is designed to cure.

There is an ever increasing reaction of conservatism in the treatment of sinus pathology. The conservative method of treatment, therefore, is advocated as a first resort. It is also important in this connection that a careful selection of cases be made. No conservative form of treatment can be expected to succeed if there is anatomical interference with drainage. In the majority of instances, however, this interference with drainage and ventilation is frequently due to the swelling of the mucous membrane, produced by infection of the sinus, and conservative methods are available to correct this condition and re-establish normal drainage of the sinus. Occasionally, allergy interferes with successful management of cases whether treated surgically or conservatively.

In addition to the intranasal treatment so familiar to the rhinologist, various forms of physical therapy have had a very important function as accessory treatment. Usually heat in some form is indicated, and for many years the value of infra red rays in this condition has been recognized and employed. Indeed in the past, Bier's passive congestion was employed by placing a band around the neck. Conventional diathermy has been employed by some, occasionally with marked relief.

When we stop to consider the pathology of acute and chronic sinus infections, it is at once recognized that one of the most important changes that takes place is an interference with the circulation. At first we have an active congestion which develops into round cell infiltration, fibrous tissue formation and gradual diminuition in circulation, as the condition progresses to the chronic stage. It is apparent that in chronic sinus infection, the simple re-establishment of drainage, while it reduces the absorption of toxins, and the consequent symptoms, does not have any effect on increasing the circulation and re-establishing a normal mucous membrane. The application of heat in its various forms always

results in an increased circulation, whatever the form of heat may be. The mechanical difficulties in the application of infra-red and conventional diathermy have interfered with the complete success of its use. The advent of ultra short wave diathermy has introduced a technic which enables us to apply our heat in a more convenient manner and concentrate it in larger doses exactly over the area desired.

It is a fact, more or less well established, that short wave diathermy results in a dilatation of the capillaries which persists for a considerable period of time. Mention has been made of the production of heat, and part of the results are due to this, but in addition, the increased circulation is probably the more important factor. It is not necessary to elevate tempearture to such a degree that it will destroy the organism per se. There is no question but that we are able to produce a greater effect on the circulation by means of short wave diathermy than we have been able to do in the past. The increased amount of local heat, together with the increased circulation and dilation of the capillaries, certainly produces a more definite effect than any other form of treatment.

Clinical Studies

During the past winter, we have had an opportunity of treating fifty-five cases of sinus infection with the ultra short wave diathermy. Most of these patients were treated in the Physical Therapy Department of Jefferson Hospital and in private practice by one of us. Of the fifty-five cases, fifty were classified as chronic and five as acute. All of these cases had received previous treatment, twelve had radical treatment and the rest conservative, and with only temporary or no relief whatever. We endeavored to certify the diagnosis in all cases by x-ray but, due to economic reasons, only thirty-four cases were so diagnosed.

The treatment of all these cases was carried out by means of an ultra short wave of six meters and the machine had a capacity of three hundred watts. In some of the earlier cases, a longer wave length was used but the results were so uniformly satisfactory with the six meters that most of the work was confined to this wave length. Condenser electrodes, treating from side to side were tried, but eventually the technic was confined to the antero-posterior method. Pad electrodes, four by six inches in size, and spaced by at least one inch of felt, were employed. One electrode was placed on the back of the neck and the other over the face covering the sinuses. This method has one disadvantage in that there is a tendency for the nose to become overheated, but we found this valuable as it acts as a guide to the proper intensity, and at all times only a comfortable warmth is maintained. The length of treatment was fifteen minutes. Most of the chronic cases were treated three times a week and the acute cases were given daily treatments. Experience has shown, however, that the chronic cases will respond much better if they can also be given daily treatments. We found that at least twelve to fifteen treatments were necessary to secure results in chronic cases, after which the treatments could be decreased to one or two a week, until all the symptoms have completely disappeared. In chronic cases, the average number of treatments was twelve. The greatest number to one patient was twenty-eight and the smallest number three. In acute cases, the average number was five; smallest number one and greatest eight. Acute cases usually respond more quickly, and five or six treatments at daily intervals produced a rapid return to normal.

It is very important to give sufficient treatment, as it is our experience that chronic cases receiving less than twelve treatments usually showed a tendency to recur. Patients are told on discharge that should they contract a head cold, they should return immediately for treatment, in order to prevent re-infection

of the sinuses. Frequently only one or two treatments are required for this purpose.

Combined Therapy

Our first cases were treated by ultra short wave alone, but later we adopted the plan of using some local treatment in conjunction with the ultra short wave and found that the results were correspondingly improved. At the Jefferson Hospital, we used a nasal layage with warm salt solution, before applying the short wave diathermy. This method consists of allowing a salt solution to flow into one nostril from a height of about two feet, while suction is applied to the other nostril. This results in a very definite and thorough cleansing of the nasal cavity, and the withdrawal of the secretion from the sinuses.

One of us in private practice has employed the displacement method of Proetz. This is also a well recognized form of treatment and is very effective in ridding the sinuses of accumulated mucous and pus. The patient reclines and the head is thrown well back. Five cc. of one-half per cent ephedrin solution is instilled into the nostril. A one-half per cent solution has been found to be less irritating and very effective. Suction is then applied to the nostril and results in

withdrawal of considerable mucous and pus.

Clinical Results

We believe that this preliminary local treatment has been of decided advantage and it is our plan to continue this combination in the treatment of all sinus infections. The results obtained in this series of cases have been classified as follows: (a) very much improved; (b) improved; (c) slightly improved; and (d) unimproved. Of the fifty-five cases treated, thirty-nine were classified as very much improved; eleven as improved; two slightly improved and three showed no improvement. In all, however, except the last three cases, relief from pain was obtained. No untoward reactions were noted in any cases. Ten reported a slight tingling sensation in the sinus after the first treatment, and thirty noticed a marked increase in discharge which persisted during the first few treatments. Following this temporary increased discharge, there was always a gradual lessening until the discharge disappeared entirely, or there was merely a slight mucoid post-nasal drip, which in no case was severe enough to be annoying. We took the opportunity wherever possible to have the case followed by the nose and throat man referring the patients, and the effects noted have been corroborated by him in all cases so followed.

The most noticeable feature after treatment was the prompt disappearance of pain, usually following the second or third treatment. In many cases, patients who had not slept well for months enjoyed their first good night's sleep. Many of these patients had submitted to radical operations without relief and all had received more or less local treatment with discouraging results.

Case Histories

The following case histories illustrate the type of case and the results to be expected:

Case I. - M. M., Central City, Kentucky. Ethmoids removed in 1907 and felt fairly well for a short while. Since that time she has had the right or left antrum washed at intervals, always obtaining some pus. In 1934, she had a radical operation on the left antrum. In June, 1934, at the Mayo Clinic, her frontals and sphenoids were opened. Following this, she felt well for a few menths but continued to have some discharge of pus. In April, 1935, she claims an abscess in the nose broke spontaneously and discharged much pus. She felt well again for two months and then her headache returned.

Came to Philadelphia September of last year and was scheduled for another operation, when she became interested in short wave diathermy. Seen in our clinic she complained of almost continual headache, much discharge and nervousness. On examination we found many crusts in the nose and considerable post-nasal drip. She complained of being unable to sleep; she was irritable and nervous and willing to go through anything for relief.

After three treatments, there was definite improvement, with absence of pain and marked decrease in discharge. After the fifth treatment, she said she was much improved and her nervous condition was better. After twelve treatments, the condition had so improved that she cancelled her scheduled operation and returned to Kentucky. A recent letter says that she never felt better in her life.

The above case was followed by Dr. H. H. Lott, chief of the nose and throat člinic, who reported a rapid and marked lessening of discharge and general improvement of the nasal cavity.

Case 2.—Mrs. T. came to office complaining of purulent expectoration, much postnasal drip, dizziness, nose bleeds, severe headaches, cough, sore throat, and swollen cervical glands, all for a period of three years.

She had been treated every winter with local applications to the nose, twice weekly, but felt only temporary relief. Her condition became so bad that she was finally advised to have an operation to help clear up this fetid purulent discharge. X-ray showed cloudiness of the right antrum, left frontal and ethmoids. Treatments were started on January 11th. She received twelve, three a week, following which her symptoms had practically all disappeared. Treatments, however, were continued once a week for eight weeks. At this time, even the swollen, painful cervical glands have entirely disappeared. Three weeks ago she developed a head cold with slight headache. This cleared up with one treatment and she has had no trouble since.

Summary and Conclusions

- 1. Anatomical interference with sinus drainage must be corrected by surgery.
- 2. Surgical treatment of sinus infection has not been uniformly successful and leaves much to be desired.
 - 3. Conservative treatment should be tried first.
- 4. Chronic infection of the sinus results in thickening of the mucous membrane and diminution of circulation.
- Ultra short wave diathermy presents a conservative method of treatment which not only rids the sinus of infection but improves the circulation and guards against reinfection.
- 6. Of fifty-five cases treated, thirty-nine showed eminently satisfactory results.
- 7. Ultra short wave diathermy is recommended as a most valuable conservative treatment of sinus infection.

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Discussions of Papers of Drs. J. Thompson Stevens, Harry K. Tebbutt, Jr., Thomas Leichner and William Henry Schmidt

- Dr. A. R. Hollender (Chicago): We are coming more and more to appreciate that roentgen therapy holds out unlimited possibilities in various nose and throat conditions which heretofore have been difficult to handle with surgical and other procedures.
- It is quite probable that the use of x-ray and radium therapy will serve more advantageously as post-operative therapy. Those of us who have had to deal with hyperplastic sinuses are cognizant of the difficulties which we frequently encounter in handling these cases because recurrences are frequent.
- I am familiar with Dr. Tebbutt's work because I have reviewed a number of his
- very fine articles. We have all been using heat in some form, either as infrared or the luminous ray lamp, or diathermy, and more recently short wave diathermy for heating up sinuses. Many of us have obtained very good results in these conditions without actually knowing what changes take place in the sinuses or their mucosal lining.
- With short wave there seems to be less timidity on the part of the practitioner for using this form of heating up acute sinuses. The fact is that some very favorable results have followed short wave therapy
- I have not, however, been impressed with results in the chronic cases, even

though we carefully select these cases. Dr. Harry Rosenwasser (New York): We have done a small amount of work with the short wave at Mt. Sinai Hospital with Dr. Bierman. We became interested in this phase of the treatment of sinusitis because a certain number of our cases of chronic sinusitis got no-

where.
Dr. Tebbutt's fine work was noticed by us some time ago and we decided that we would carry on, so to speak. We had a thermocouple made by Leeds & Northrup, essentially the same as the one that Dr. Tebbutt used. We began to find the normal variations of temperature in different parts of the normal nose. found in order to use a thermocouple in many of the children that we had to resort to the use of cocain and to resort to epinephrine. We began to notice strange things happening, that instead of getting a rise in temperature after a short wave treatment, as we thought we were going to get, the temperature would fall. It was quite obvious that cocaine had a definite influence on the temperature of the nose and its ability to rise.

We found that in 25 operated sphenoid cases 23 cases showed a rise in temperature from a half degree to about three degrees in one exceptional case. Most of the sinus cases we treated were chronic, but we intentionally selected this type.

As I said before, we did not treat any cases of acute sinusitis so that I do not know what effect short wave would have

in those instances

Dr. Charles R. Brooke (Newark, N. J.): There is no doubt that the x-ray has very definite effects on certain severe nasal conditions. When we can relieve pain in these types of cases, we have accomplished something definite because the nauscous, severe nasal and headaches are most distressing to the pa-

The use of radium in the polypoid cases is a treatment that we certainly rec-

ognize today.

My experience with short wave has been very limited because in the Veter-Administration, where I do most of my work, this therapy has not been accepted as yet. I do believe that it cepted as yet. I have found with the few cases I had that the reactions were rather severe for the first 24 hours, but after that definite amelioration of symptoms occurred.

I was interested in the results obtained by Dr. Tebbutt in his research work be-cause, as Dr. Hollender has said, we have been employing conventional forms of heat radiation for a number of years, but we did not know exactly what was going on in the sinus mucosa. Our results clinically check very satisfactorily, that

we are getting im, rovement. It is interesting to know through the work with his thermocouple readings just

what happens in the 13sal mucosa. We still employ, of c urse, our radiant energy and conventiona diathermy with

very gratifying results. I think the technic has to be varied according to the type of case, whether it is acute, sub-acute, or chronic and whether the severity is great, whether there is surgical obstruction which naturally has to be cleared away in order to derive the best results. But the doctor in going over his experiments said that regardless of the temperature drop drainage improved. is one thing we strive to accomplish. Naturally, with the production of drainage symptoms are markedly relieved.

Mr. Howard A. Carter (Chicago): Recently the question of treatment of sinusitis by short wave diathermy came up before the Council on Physical Therapy. The reason it came up was because the claim was to be made in advertising mat-Naturally the Council on Physical Therapy is concerned about claims made

by manufacturers of apparatus.

In regard to sinusitis, many questions were sent out to men who, in the opinion of the Council, were believed to be specialists in the field. The results that came in indicated that it was a 50-50 proposition. There were about as many well-qualified men who said it was good as there were well-qualified men who said it was not good. Therefore, in that regard we thought of Milliken's statement to the effect, that when it is at least substantially good there must be a nine out of ten in agreement, and the Council felt they did not have sufficient evidence.

The Council finally left it this way, that claims could be made to the effect that the head or sinuses could be treated. That is, you could apply energy to the head or to the sinus, but you could not treat sinusitis. I trust that you catch

the significance there.

Dr. Lewis J. Silvers (New York): Dr. Leichner this morning has definitely shown that patients taken prior to operation, and those treated post-operatively with no intent of result have definitely shown improvement and in some cases were cured by the use of diathermy, which in his case happened to be short

We must first resort to means enhancing the ventilation and drainage of our sinuses prior to instituting any method. If we get no ventilation and drainage, it makes little difference what method is em-ployed, results will be unsatisfactory. Ventilation and drainage are of primary

importance.

Secondly, and a very important factor, is the finding recently of Dr. Fenton in relation to the immunological reaction that occurs with the employment of physical means. The reticulocyte, or reticulo-endothelial cell which comes to the site of the lesion when damage is done in any part of the body, the action of that cell is markedly enhanced by the use of physical means. I feel that we are doing more from an immunological standpoint by using physical means than we are actually doing from any other viewpoint.

Then, having established ventilation and drainage in our orthodox manner,

and with due consideration for such nasal pathology as may exist, short wave should prove highly efficacious in relieving pain and by restoring the sinus to as nearly as normal state as is possible.

Dr. J. Thompson Stevens (closing): In the treatment of chronic nose and throat infections I like best to de-pend upon the roentgen rays, for the reason that in placing or implanting radium you must disturb the tissues. other words, you disturb their rest, which is not done when the roentgen ray is

We were taught years ago that rest was one of the most important things that we could institute in the management of almost any disease. Chronic infections of the nose and throat I do not believe are exceptions to the rule.

There is a tremendous field for the use of radium in the treatment of polyps. you know, following removal of polyps by surgical measures, recurrence is almost a rule, whereas, if the polyps are first removed and radium placed against the healing wound, recurrence is the exception. People who have nasal polyps, of course, appreciate anything that can prevent the recurrence of their troubles.

Dr. Harry K. Tebbutt, Jr. (closing): In regard to Dr. Rosenwasser's question about cocain and adrenalin, did not use cocain and adrenalin. I felt that the action upon the blood vessels in the areas to be tested might change the picture entirely.

The patients that we tested or experimented upon had old chronic hyperplastic sinusitis and asthma. Many had had numerous intranasal operations for relief. Most of these experiments were done on the maxillary sinus because it was a little more accessible and had intranasal open-When the thermopile was placed ings. in these sinuses the opening about the shaft of the thermopiles was closed with a piece of cotton in order to make the conditions more nearly normal.

In one or two cases we did put the tip of the thermopile into the sphenoid sinus. We were quite surprised to see the temperature drop there, also. The drop, as I remember, was not quite as much as it was in the other sinuses, but it was practically a degree, as I recall it from the experiment. We questioned it from the experiment. We questioned that result when we saw the temperature drop and the thermopile was immediately recalibrated by means of this water and an agitator and by the use of a thermometer was found to be correct. Repeated experiments on several other oc-casions got a fairly constant result.

The plates that we saw in the diagram were primarily for heating up smaller animals, like guinea pigs, rabbits and dogs, to see what effect the high frequency had upon their blood.

I do not want to be misunderstood. I am not advocating the use of some of these agents at the expense of the others at all. I was curious to see what did happen when these various agents were used. I think, however, the lamp forms a very practical method of treatment for homes. You cannot take the average pa-tient out of bed and bring him to the hospital three or four times a week to give high frequency treatments. fect of the lamp is probably as good, or almost as good — that is a little rash - as high frequency. perhaps fore, I think it has a very practical value.

Dr. Thomas Leichner (closing): It was always my impression in treating chronic nasal sinus infection that the ultra short wave heated up the sinus mu-cosa. Now we have Dr. Tebbutt who says that the temperature of the sinus is lowered, and we have Dr. Rosenwasser who says that it is elevated. I would like to know how these two men carreconcile their diverse opinions.

Physical Agents in Relation to the Treatment of Nasal Sinusitis — Tebbutt, Jr.

(Continued from page 487)

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TREATMENT OF HEMIPLEGIA *

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During the past years we have treated in the physical therapy department of Bellevue Hospital a rather large number of residual hemiplegics, with histories dating back from two to twelve years. In these cases the deforming and crippling pathologic changes were firmly established. Although it seemed improbable that anything in our therapeutic management could have any lasting beneficial effect on the spastic and contracted limbs, we endeavored to give the patients the benefit of the doubt. For a period of five years all hemiplegics referred to our service were put through an intensive course of physical therapy prescribed in accordance with the most advanced thought. This included cerebral galvanism and diathermy, massage, re-educational gymnastics, occupational therapy, hydrotherapy and low voltage interrupted currents. Treatment was continued for many months. Everything possible was done to rehabilitate these patients. Yet ultimately, we reached the apparently inevitable conclusion that here, as elsewhere, once the pathologic deformities are firmly established, physical therapy is futile.

In reviewing the literature on this subject, I found reports of successful rehabilitation of old spastic hemiplegics. The results obtained by, and the consequent optimistic conclusions of Bourguignon¹, Leavy², Grossman,³ and Mann⁴ are not substantiated in our own experience. In spite of conscientious and thorough efforts, we are forced to conclude that no therapy is of any value in the rehabilitation of an established case of spastic hemi-

plegia, and that the condition is incurable.

Physical therapy in such cases is justifiable only for the preservation of morale. The physician, naturally, will not deprive the invalid of any lingering hope of possible rehabilitation by bluntly asserting the futility of further treatment. In our own clinic, where we serve the very indigent and lowly, we keep the knowledge of the hopelessness of the case to ourselves and treat the patient at least once weekly.

Appreciation of the incurability of residual hemiplegia led to the query: Can we by means of early and intensive treatment prevent the development of the crippling deformities? We have succeeded to a limited extent in poliomyelitis, can we not do as much in hemiplegia? A search of the literature disclosed scant information on the treatment of hemiplegia in its

early stages.

Last year I communicated with the directors of our four medical divisions and of the neurological service. Stressing the futility of trying to rehabilitate the residual hemiplegic, I asked for cooperation in testing the possible effectiveness of early, preventive treatment. I have been accorded the heartiest cooperation in the proposed plan to test the efficacy of physical therapy in a given condition. Arrangements were made to notify us as soon as a "stroke" patient was admitted to the hospital. A qualified technician was assigned to supervise this work and was given ample assistance. From July, 1935, to July, 1936, 230 acute hemiplegics were admitted. Of these 116 died within a period of ten days, due to the fact that Bellevue as a centrally located city hospital serves as a clearance depot for numerous near fatal cases brought in by ambulances from various hospitals.

^{*} Read at the Fifteenth Annual Session of the American Congress of Physical Therapy, New York City, September 9, 1936.

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Presumably, one of the main reasons why so little attention has been paid to the problem of rehabilitation of the hemiplegic, is that many physicians believe that in almost all of these cases the prognosis as to life and recovery of function is bad; that, as a rule the patient is shortly carried off by a recurrent attack; and that even if he manages to survive, the progressive development of the crippling deformities can be neither prevented nor slowed. Routinely the physician will work like a beaver to "pull" his patient through the acute attack and then, if the latter's economic status permits, he will assign him to the care of a lay technician with the cursory instruction: "Give the patient massage, exercise and electricity." It is, of course, unfair to ask a lay technician to become a prescribing physician. Uniformly such treatment is stereotyped, aimless, and consequently definitely harmful, leading to increased hypertonicity and deformity. What improvement the patient does get in such instances, is purely spontaneous, perhaps in spite of the technician's efforts.

The assumption that the prognosis as to life in hemiplegia is uniformly bad, is wrong, as can be appreciated when one recalls the large number of residual hemiplegics met with in every walk of life. "A second stroke occurs only in a minority," asserts Hobhouse⁵. A great number of hemiplegics live for many years, enjoving relative health, but are badly handicapped by their deformities. A serious effort to prevent the latter is therefore fully justified.

Shall we attempt rehabilitation in all cases of recovered hemiplegia? The answer must be, no. Judgment is required. Consultation with the internist should be held to determine the prognosis as to life in each case. Where the etiologic factor (e.g., extensive and severe arteriosclerosis with angina pectoris; a fibrillating heart; advanced age combined with cardiac or general debility) definitely dooms the patient to an early death, any serious efforts at rehabilitation are, of course, inappropriate⁵. Our efforts must be concentrated on those with a favorable prognosis.

Evaluation of Prognosis

The central lesion, irrespective of its etiology or exact nature, is the prime factor in determining the extent of the immediate and ultimate damage. If the lesion is extensive and involves vitally important areas, the prognosis both as to life and as to recovery of function will be correspondingly poor. If the lesion is moderate or mild, our efforts may be rewarded with relative success. Aside from the seriousness of the central lesion, the patient's inherent capability of successfully combating the pathologic process is a most important factor in the ultimate prognosis. This recuperative power varies greatly in individuals.

The more rapid the central lesion is healed, the extravasation absorbed, the damaged brain tissue replaced by a scar, the more thorough will be the restitution. Appreciation of this has brought forth various therapeutic suggestions to hasten healing. One of the fundamental concepts of physical therapy is that localized hyperemia by increasing the flow of fresh blood to the injured part promotes recovery. We should therefore make an attempt to increase the flow of blood to the site of the brain lesion. However, there may be weighty contraindications, as for example the friability of the cerebral blood vessels. Internists and neurologists are certain to object to any artificial increase of the circulation to the brain. They fear an exacerbation and prefer the slow but safe process of spontaneous healing. Conservative medicine demands that we wait until the acute insult has definitely subsided before we use any measures to increase the cerebral cir

culation, and these at all times will have to be moderate and used with due care.

Cerebral galvanism and diathermy have been advocated as effective measures of increasing the local circulation. It is speculative as to just how much heat either of these two agents can produce within the brain. Bearing in mind the fundamental laws governing the flow of electric currents, we must conclude that relatively very little current will find its way to the brain, and consequently very little heat will be produced locally. However, as counterirritants, which they admittedly are, these currents are bound to promote a localized hyperemia speeding up to a degree the flow of blood through the cranial vessels. The application of radiant heat to the face or the neck, should be equally effective in bringing about a moderate increase of the circulation through the brain — sufficient for the physiologic effects sought. Similarly, when we apply heat to the involved extremities we incidentally speed up the blood circulation throughout the whole body, including that of the brain. Although we have used both cerebral galvanism and cerebral diathermy, we do not consider either one a valuable or necessary adjunct in the treatment of hemiplegia.

The immediate effect of the insult and the coincidental profound shock is to produce a flaccid paralysis of the affected limbs. The latter are clammy, cyanosed, edematous in the dependent portions — all signs of deficient circulation. With astonishing rapidity degenerative changes set in: Fibrositis, periarthritis, atrophy. A great deal of the pain in paralyzed limbs is probably due to arthritis, although it may also be of central origin, attributed to an irritation of the optic thalamus.

Routine Therapy

During the flaccid stage which lasts from four to six weeks, we routinely prescribed radiant heat, moderate in intensity, twice daily for 15 minutes to each limb, and for 5 minutes to the face, if the latter is involved. To meet the problem of heating the whole length of a limb, we developed a therapeutic lamp with an elongated reflector in place of the conventional round reflector, which tends to focus the heat on a rather limited area.

The heat application was followed by massage: Effleurage, friction and kneading, the manipulations being modulated to avoid painful reaction. The object of this combined treatment is to improve the circulation, reduce the edema, and to prevent any tendency to fibrositis or arthritis. Each joint was systematically carried through a series of passive movements natural to that particular joint — movements in full arc, or as far as was possible without causing discomfort. Here, too, our object was to prevent arthritic changes and resultant ankylosis. The flaccid muscles of the face and the limbs were treated with some form of low voltage interrupted current: Galvanic, faradic, or sinusoidal.

A statement "Electricity is useless if not actually harmful in hemiplegia," is recurring with amazing frequency in medical and neurologic text-books. This sweeping condemnation suggests that none of the authors have taken the trouble to ascertain its correctness. It is undoubtedly true that "electricity" applied without a thorough grasp of its exact physiologic effects is both useless and potentially harmful. So is the unintelligent application of any therapeutic agent. Intelligent employment of low voltage interrupted currents is invaluable and irreplaceable in the treatment of flaccid paralysis. These currents produce muscular contractions of desired intensity at a time when voluntary motion is suspended. Active muscles mean an active circulation, prevention of disuse atrophy and degenerative changes,

and reduction of edema. I know of no single valid objection to the use of these currents, and therefore strongly urge their use in the flaccid stage of paralysis. Physical therapists differ in their preference of the form of interrupted current: Sine, slow sine, surging galvanic, or faradic. I do not believe it matters which one we use in this instance. We seek to produce mild contractions and these can be obtained with any one of these currents.

The English school of physical medicine advocates the use of the straight galvanic current in the early stages of flaccid paralysis on the theory that this current has a mildly invigorating action on the muscles and the nerves, even though it does not produce actual contractions. The conclusions are wholly empiric and require experimental substantiation.

Technic of Muscle Stimulation

In our work we used a portable faradic outfit. A rather large indifferent electrode was placed over the corresponding area of the spine (cervical for arm, lumbar for leg). The smaller, active electrode was applied with a stroking motion to various groups of muscles, moving about from area to area to avoid any possible strain or fatigue. I can see no advantage in applying the electrode to motor points. We sought to obtain slight contractions, just visible or just palpable. The facial muscles, if involved, received similar treatment, following which the saggy cheek muscles were

strapped to prevent stretching.

During the flaccid stage we also paid heed to the position of the affected limbs. The shoulder was kept in abduction and slight external rotation by placing a pillow in the axilla and resting the arm on it. If the limb was edematous, it was kept elevated. "Dropping" of the foot was combated by supporting it with another pillow. Where the arthritic changes showed undue progress, the limb was immersed in hot water at least once daily, and this was followed by massage and passive movements of the affected joints. Finally our technicians were instructed to cooperate with the nurses in guarding against bedsores. Macerated or irritated areas were painted with tincture of benzoin and dusted with zinc stearate.

To carry out the planned routine and yet to avoid any undue local or general fatigue, it was necessary to apportion the work throughout the day with intervals of rest. We did not find this particularly difficult, since we usually had a considerable number of patients to treat. In private practice, an intensive routine of this sort would require the services of a full time technician, which involves consideration of the patient's economic

status.

The treatment was given daily. I have never been a believer in "spurt and spasm" therapy. To give physical therapy every 48 hours is an invitation to failure, the prolonged interval nullifying whatever beneficial effects may be attained in one seance. Intensive, persevering treatment will frequently produce beneficial results where spasmodic efforts utterly fail.

As the turning point is reached, signs of spontaneous recovery begin to appear. Motion, slight and spotty, is noticed in various parts of the affected limbs. Neurologists tell us that the earlier the onset and the more rapid the rate of spontaneous recovery, the more favorable the ultimate prognosis. Left to itself this spontaneous recovery, which is said to continue over a period of six months to a year keeping pace with the progressive healing of the central lesion, will distort and cripple. Our aim is to aid and guide it, in the hope of bringing about the desired rehabilitation. Intercurrent complications may delay the onset of recovery and the early start of treatment. To anticipate and thus prevent these possible complications, the physician aims to sit up the patient in bed or in a wheel chair,

just as soon as is consistent with sound medical practice.

With the onset of recovery we watch the patient rather closely. If the hemiplegia is of the atonic or flaccid type, the prognosis as to recovery of function is as a rule more favorable than in the spastic type. The routine of physical treatment will, of course, be radically different from that indicated in the care of the "spastics." We continue with the application of heat, massage, exercise and the interrupted low voltage currents. As the patient begins to regain voluntary power, the passive exercises are changed to assistive, and then to active. In the flaccid type, the arm, during the early stages when it hangs like a dead weight, should be supported in a sling to avoid stretching of the capsule of the shoulder joint. The foot if "dropped" will require a suitable brace. Incidentally, it is in this type of hemiplegia that the arthritic changes are most devastating. Our ultimate results with the flaccid type of hemiplegia have been most encouraging.

Spastic Hemiplegia

The situation is different with the spastic type. As we watch the early cases, we note the gradual appearance of hypertonicity which will shortly lead to spasticity and contractures. Can we abort the classic deformities of spastic hemiplegia? The hypertonicity is attributed to an escape of the lower motor neurons from the inhibitory control of the upper motor neurons, due to the destruction of the pyramidal tract fibers by the central lesion. This hypertonia varies in degree with the extent of the damage to the pyramidal tract, is less in sleep, and is intensified during any mental

or physical strain.

Our problem in these cases appears to be to attempt to restore the inhibitory control of the lower motor neurons, or failing in this, to find means of effectively combating the hypertonicity. Theoretically if the destruction of the pyramidal tract has not been complete, it may be possible to "educate" or train the surviving fibers to intensify their function. Again, most neurologists believe that the pyramidal tract is not "the exclusive carrier of volitional muscle control," but that there are associated tracts which are capable of performing the same duty. If that is correct, and these associated tracts have not been injured, it may be possible, by means of carefully planned and persistent re-educational gymnastics to establish new pathways of control. This is, however, quite speculative, but in our need we are justified in even grasping at a therapeutic straw. Certainly, the implied method of rehabilitation deserves a most earnest trial.

Re-education, if at all possible, is certain to be slow. In the meantime we must make every effort to combat the formation of the spastic deformities. Our mind turns to the possibility of achieving this by suitable splints and braces, as we do in poliomyelitis or in spastic paraplegia. The idea of using splints in the treatment of hemiplegia is an old one, yet it does not seem that anyone has ever made an intensive effort to test its ef-

fectiveness in the early stage of spastic hemiplegia.

Even assuming that restoration of volitional muscle control is definitely out of the question, persistence in effective splinting combined with physical therapy may still prove invaluable in preventing contractures. It is not impossible that the prolonged use of splints and braces may lessen the hypertonicity and spasticity. The body has been known to adjust itself to newly created demands upon it. It simmers down to a combat between the hyperactive reflexes and the restraining splints — with a chance that the latter may win out.

At Bellevue Hospital, we applied light plaster-of-Paris splints at the first signs of spasticity. We concentrated particularly on the hand and the

foot. The shoulder joint was held in abduction and external rotation by means of pillows, the elbow in semi-flexion and supination, and the hand and fingers in hyperextension by means of an anterior molded splint. The leg and the foot were kept in a posterior molded splint to combat the position of equinus. The splints were removed twice daily during physical treatments, allowing the strained tissues to rest. Light weight molded wire splints or orthopedic braces are probably better for the purpose than the

heavier plaster-of-Paris splints.

With the onset of spasticity we continued the heat applications, but massage was limited only to the joints if the latter showed any tendency to arthritic changes. The use of interrupted currents was discontinued. Some advocate the continued use of these currents on the "weaker" muscles, i. e., the extensors of the arm. The objection to it is that the application of the current anywhere on the limb is bound to lead to an increase in general hypertonicity. Passive motion is continued, adding slow, steady stretching to prevent contractures. As soon as the patient is able to cooperate we add assistive and active re-educational exercises. Immersion of the limb in a local warm bath is of value in obtaining temporary relaxation and incidentally increasing the circulation. Complete mental and physical relaxation is most essential to the attainment of best results in the administration of re-educational gymnastics. The Hubbard tank, which in a way assures both, should therefore be of real value in the care of the hemiplegic. A home tank can be constructed at a moderate cost. Placed on the floor, it enables the invalid to enter it with relative ease. The ordinary bath tub will do in a pinch.

Re-educational gymnastics must be carefully planned to meet the specific needs of each individual case. The exercises must be graded in intensity and complexity. It is of advantage to use symmetrical exercises, the two limbs working in unison, or the good one helping the paralyzed limb. Whether one uses passive or active exercises, every effort should be made to carry the movements through the full arc. Insist on correct form rather

than the "easiest way."

Psychic and physical cooperation of the patient is of great importance. As soon as he is out of coma and has recovered his mentality, it is necessary to point out to him how he can be of aid. The hemiplegics vary greatly in their mental reaction to the "stroke." Some remain morose, pessimistic, irritable, convinced that they are doomed and that efforts at rehabilitation are futile. This type will not cooperate, making one's task difficult and perhaps hopeless where whole-hearted cooperation might produce an excellent result. Another difficult type is the patient who fails to recover mentally and is thus unable to cooperate. Still others are fatalists, resigned to their invalidism, seeing little sense in all the "fuss" of intensive physical therapy and annoying braces. However, there are a great number who display the "passionate, absorbing, almost bloodthirsty clinging to life" the poet speaks of. They will cooperate fully, often even to excess. Encouragement and praise are aids in stimulating interest and cooperation.

The economic question is an important one. Everything else being equal, the patient whose status permits the employment of a properly qualified technician working under the guidance of a physical therapist and having available the necessary apparatus, will naturally obtain better and more rapid progress than the poor man who must accept whatever treatment he is able to obtain. We may be willing to provide the indigent clinic patient with daily, intensive, capable care, but the patient may be unable to take advantage of it. Following the discharge from the hospital the patient is instructed to report to the clinic for continued observation and physical

therapy, but this involves hardship. Someone must accompany the invalid, for often he is too disabled to go by himself. The trip to the clinic involves a severe mental and physical strain which may nullify whatever beneficial effects be may obtain from the treatment. It is evident that the plan of treatment we propose while it offers a possible solution to the problem of rehabilitation, may be difficult to carry out. Yet, any serious deviation from the plan, particularly as affecting the frequency of treatments in the early stages may nullify all our efforts. We have already stressed the importance of avoiding local or general strain or fatigue. These patients tire easily, particularly in the early stages and must have plenty of rest between exercises.

In hemiplegia, the lower limb is the first to show signs of recovery and efforts at re-education may be started as soon as the patient is able to cooperate. The following exercises can be carried out in bed: Flexion of the knee, abduction and external rotation of the thigh, dorsi-flexion of the foot, flexion of the lower limb on the trunk. As soon as the patient is ambulant, he is taught to hold on to the sides of the bed and try knee bending, symmetrical, gradually increasing the depth of the bending. Standing between two chairs for support, he may practice various exercises and particularly that of putting the paralyzed leg forward by heel-toeing. He should be taught "straight-line" walking and stress the importance of fighting the tendency to swing the leg like a scythe. The rolling walking frame is a valuable piece of equipment in teaching straight-line walking. When the patient graduates to crutches or a cane, one should adhere to the same principles of re-education in proper walking. The tendency to the position of equinus which is one of the main causes of handicapping the patient, must be combated. In general one should stress exercises for abduction and external rotation of the hip; flexion of the knee; and correct walking habits. The stationary bicycle and finally walking up and down stairs are of added value.

The shoulder requires concentration on abduction and external rotation. Prevention of arthritic ankylosis and contractures is essential if movement of this important joint is to be retained. In exercising, the good arm can aid the paralyzed one, by interlacing the fingers or by grasping a wand Gaenslen's⁶ swing exercises should be of real value here, but involve a rather complicated mechanism plus the need of considerable space. Pulleys and weights can be of aid, if used with due care.

In the elbow we are combating a tendency to flexion contracture and pronation of the forearm. With the arm immersed in warm water aiding in relaxation, passive and active stretching of the joint is of value.

The fine movements of the hands and fingers are the most difficult to restore. It is here that purposeful rather than calisthenic exercises are probably more effective as well as more interesting. There are numerous suggestions as to useful exercises for the hand: Grasping a ball. Picking up a ball. Bouncing a ball. Building blocks. Piano. Typewriter. Writing. Drawing. Painting. Buttoning. Sewing. Filling and refilling a glass of water. Eating with knife and fork. Opening the knob of a door. Putting the hand in various pockets, and the like.

Summary

If we are to base our conclusions as to the effectiveness of our plan of treatment on the observations of our patients during their stay at the hospital, they would be indeed rosy and optimistic. We obtained what appeared to be almost uniformly satisfactory results. We seemed to have no difficulty in combating any tendency to spasticity. Unfortunately we were unable to follow through on our study. Our patients as soon as they re-

covered sufficiently to become ambulant dispersed to the four winds. In an effort to check on their progress after leaving the hospital, I sent out a group of investigators to the homes of 100 of these patients. The returns were most unsatisfactory. Many of the patients had "disappeared." Some were hospitalized in institutions. The reports from the small number we were able to reach were most encouraging.

It is evident that a study of this type cannot be carried out properly in an "acute" hospital, nor in a hospital for chronic affections where, as we pointed out, no improvement can be expected in established cases of hemiplegia. Perhaps the best hope lies in enlisting the general practitioner in the task of testing the effectiveness of early physical therapy and splinting in preventing the deformities of spastic hemiplegia.

Conclusions

1. Chronic or residual spastic hemiplegia is incurable. Once permitted to reach the stage of established deformity, nothing can be done for it.

2. The impression is that the profession has neglected the hemiplegic because of a conviction that his prognosis as to life and function is bad.

3. This conviction is erroneous in numerous instances.

4. An attempt should be made to prevent the formation of deformities and thus assure rehabilitation by means of early physical therapy and effective splinting. This routine should be followed as long as there is progress.

5. The results obtained in our series of hemiplegies have been most

encouraging.

6. The suggested routine is neither new nor revolutionary - merely a clarification of various methods found to be of value.

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RELATIVE MERITS OF AUDIOMETRIC AND TUNING FORK TESTS *

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PHILADELPHIA

Hearing is a normal physiologic phenomenon perceived by the ear and accomplished by the perception of vibrations from an acoustic medium. This medium may be the human voice, the telephone, a musical instrument, noise, tuning fork, watch, audiometer, hearing prosthesis, and the like.

While the human ear is best adapted to the human voice, modern civilization with its complexity of noises and sounds has found that it has become the receptor of many sounds wholly different in character from that of the voice. Hearing is a subjective phenomenon. Many elements come into play, such as physiologic variations, anatomic anomalies, age, intelligence, volume, tactility of sound and special ear training.

The human ear can readily distinguish different frequencies, graphs of which can easily be plotted. The scale of tones appreciated by the human ear are divided into octaves for testing purposes. Frequency is the number of vibrations per second and each pitch has a definite frequency. Loudness or intensified sound is difficult for the human ear to differentiate as intensified sound does not register in pitch variations. In order to measure loudness it is necessary to use some instrument of precision.

The human ear is so constructed that it is able to recognize high, medium and low tones. This hearing range is approximately between 18 and 18,000 double variations per second. The hearing fields therefore must be searched from the minimal possible perception of sound to that of the maximum. Human conversation has its optimum acuity between 300 to 2500 cycles per second.

Sound is transmitted to the ear by air or bone conduction or a combination of both. Hearing tests must therefore utilize both air and bone conduction. According to Hulka, the insulation of the head for sound by air is 50 decibels and by bone 3 to 6 decibels.

As previously stated the human ear is best adapted to the human voice. Early hearing tests were performed only with the whisper and spoken and high pitched voices. These tests were qualitative in character and the results obtained were dependent upon the distance, the type of voice, the acoustic properties of the room, the words, the letters, the syllables and the expression employed in testing. Therefore these tests were of value only to the otologist who was doing the testing, since it was purely a personal record of his own voice. The interpretation of the result was individual rather than universal. Since this was simply a comparative qualitative test and variations depended on so many factors, otologists sought some standardized mechanical means, such as tuning forks, monochord and audiometers to chart and graph the acoustic fields. Audiometer and tuning fork tests made an attempt to measure tone perception quantitatively as well as qualitatively. In order to grasp the acoustic range we must have standardized and accurately calibrated physical means of producing variations in pitch and intensity of pitch. The average city office is noisy. The results obtained therefore are not entirely

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accurate, even though standardized means of testing are employed. For practical purposes we disregard this noise factor since the tests are always performed in the same manner.

Charts of deaf patients examined in this noisy atmosphere invariably give the impression that the patient can hear better than he actually does. Accurate scientific hearing tests can only be obtained in sound proof rooms.

The Tuning Fork

The tuning fork is a convenient instrument for the testing of hearing. However, in order to be assured of accuracy, the forks should be standardized and thoroughly calibrated with the known decrement before they are employed.

A good tuning fork should have a prolonged vibration period of at least 2 minutes by air. The three forks employed for air conduction are the 128, the 512, and the 2048. In my experience the 512 tuning fork with a prolonged vibration period is best adapted to the average tests for both air and bone conduction.

Since hearing is subjective in character, we must be aware of overtones, vibrations and tactility. In unilateral deafness, we must dampen the normal ear in order to eliminate the possibility of borrowing from it.²

The tuning fork should be struck with a pleximeter that will produce an approximately standard vibration as otherwise there is apt to be an element of variation. The ear is also a tactile organ and one must be careful not to interpret vibrations as the reception for sound. It is important that a watch be employed as very often the otologist depends upon his ear to check the vibration period. This method, too, represents a variable element.

We know that normally air conduction is greater than bone conduction and also that normally there is a Rinne positive. Until the advent of the sound proof room it was thought that air conduction was always twice that of bone conduction. At present we know that air conduction may be normal and bone conduction diminished. It has been established by many otologists and physiologists that sound energy transmitted to the cochlea is not equally distributed in all individuals. It might be well to recall that diminished bone conduction with normal hearing by air is known as Wanner's symptom. Bone conduction is a direct test of the cochlea because by means of this we directly stimulate the acoustic nerve.

In 1930, in a series of 200 normal cases we observed that although the air conduction is normal there may still be a diminution in bone conduction. Therefore we can dispel the thought that the ratio of air conduction is twice that of bone conduction. We found that in 55 per cent there was normal air and bone conduction; in 39 per cent slightly diminished Schwabach and in 6 per cent a marked loss in bone conduction. These statistics closely coincide with those of Antonio Ciocco.³

Tuning forks are of little value in testing patients with a hearing loss of 50 per cent or over, especially when frequencies 128 to 2048 are employed. Tuning forks with frequencies above 2000 are of little value as they are not readily perceived by bone conduction.

Bunch⁴ stated that the higher frequencies become less acute with age and that there is a decrease of approximately 1 sensation unit yearly after 30 years of age. A high pitched tuning fork has a short vibration period and therefore the source of error is frequent. In testing high frequencies it is best to employ the audiometer for accuracy as the tone can be sustained and the pitch intensified.

Differential Tests

The primary purpose of these tests is to arrive at a definite diagnosis and prognosis. It would be next to impossible to determine the type of deafness by air and bone conduction without the aid of the tuning forks. In testing the acuity of hearing we are essentially concerned with conductive or perceptive deafness, otosclerosis or a combination of all. In purely conductive deafness there is a loss of the low tones by air and as the frequency ranges are raised the air conduction improves and becomes normal; the bone conduction remains the same. In purely perceptive deafness there is diminished bone conduction (Schwabach) with a definite loss in the high pitched frequencies. The hearing defect is in the cochlea and the manner of the sound transmission whether by air or bone is immaterial. But the important finding is diminished bone conduction and a loss in the high pitch. In mixed deafness the maximum hearing acuity is in the middle range while the low and the high pitched frequencies are diminished or completely lost.

In otosclerosis, tuning forks will denote a loss in the low frequencies with a relative increase in bone conduction and a definite Rinne negative. The history and otoscopic picture will also help to substantiate the diagnosis.

Bone conduction is physiologic and its variations may be normal or pathologic. In the young — bone conduction is long; in the middle aged it is lessened; in the old markedly diminished. With the average tuning fork tests we generally can arrive at a diagnosis as to the type of deafness. However, the tuning fork has its limitations. For example, a high pitched tuning fork has a short vibration period which cannot be heard by bone and the low frequency fork cannot be intensified. Therefore where the tuning forks fail, the audiometer can substitute the frequencies and intensities that are missed.

It might be well to mention that the otologist should not use for comparison his own ear but should use the tuning forks as the standard. The otologist may have an acute upper respiratory infection with a tubal congestion. He would then have a high relative bone conduction. When testing by comparison the patient would have a diminished bone conduction. Hyperacousis as well as hypo-acousis on the part of the otologist might be another reason for false interpretation.

Audiometer

The audiometer is an instrument of precision and aims towards standardization and accuracy. It has an advantage over the tuning fork in that its tones are pure and free from harmonics; it possesses the desired pitches and frequencies and we can at will increase or decrease the volume of intensity. In view of these qualities, we can penetrate more thoroughly into the sound fields and thus discover isolated islands of hearing.

The audiometer can sustain tones indefinitely which is especially important when testing perceptive deafness where the high pitched sounds are deficient. In fact in all cases of perceptive deafness, the audiometer is indispensable because the high frequency fork has a short vibration period and is therefore of no value.

The audiometer enables us to make graphs which represent the patient's hearing loss or the amount of hearing present. These graphs can be universally understood as they are calibrated in decibels representing so many sensation units, which is an international language.

The Brenco Audiometer⁵ is calibrated in such a manner that although it is based upon a precise calibration in terms of decibels, it gives readings directly understandable to the otologist in percentage loss of hearing. It

therefore makes it unnecessary for the otologist to understand the mathematics of decibels.

Medically, the audiometer is not used in otiatry alone. It can be adapted to medico-legal work and in the industrial field for the purpose of determining the fitness of a candidate for employment. Furthermore we can make comparative studies for the purpose of determining improvement or otherwise.

There are many types of audiometers on the market today. The Phonograph type, the Western Electric, which has dry batteries, and others that are connected to the house current. Most of the audiometers are calibrated according to the Fletcher formula in the form of decibels.

Mr. L. Podolsky has called our attention to the fact that every audiometer has an attenuator which is difficult to standardize. Every attenuator must be calibrated with the audiometer and the receiver with which it is to be used, so that it will be mathematically and scientifically accurate. Most audiometers did not take into consideration the standardization of the receiver. Therefore, as the sound is transmitted through the receiver there is an error in the calibration due to the non-uniform frequency response of the receiver. This observation can readily be substantiated by taking receivers of the same make and testing the same individual, when one will find variations in the graphs. If we take receivers from the various audiometers on the market and test them, we find that there is a variation not only in the intensity but in the frequencies. We must conclude therefore that not only must we standardize the attenuator to the audiometer but we must also standardize the receiver to the audiometer. This is one of the elements of error which we have detected in the audiometer.

Knudsen and Jones⁶ introduced a new type of audiometer which not only tests hearing acuity but determines the type of prosthesis best suited for the individual. Audiometers of this nature, if perfected, offer a great deal of promise. The otologist will then be in a position to prescribe the type of hearing aid required for the individual just as the ophthalmologist prescribes lenses for his patient's eyes.

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ELECTRO-ACOUSTO TESTOMETER *

Its Value for Accurate Timing and Recording of Bone Conduction Tests

M. MARTYN KAFKA, M.D.

BROOKLYN, N. Y.

I have observed for a few years that there are several inaccuracies related to bone conduction tests in diagnostic work of pathologic conditions of the middle and internal ear. It has been my aim to present to the medical profession a useful instrument which will accurately record and time the most commonly used bone conduction tests in its relationship to defects of hearing.

Mechanization of Tests

This new device is primarily founded upon the Schwabach bone conduction, Rinne and Weber tests. As is known, the Schwabach test as described by Schwabach himself, is exclusively a test of bone conduction. The duration of perception of the tuning fork held over the patient's mastoid being compared with that over the examiner's mastoid. Since the tuning fork is struck and placed over the patient's mastoid process and the patient indicates that he no longer hears the sound, the examiner quickly transfers the tuning fork to his own mastoid process and if he then hears the tuning fork vibration for some considerable time after, it is assumed that the patient's bone conduction is reduced and that the diseased process exists in the sound perceiving mechanism. If the examiner should fail to hear the tuning fork after the patient no longer hears it, this method is reversed viz. the tuning fork No. 256 D.V. is struck and placed against the examiner's mastoid until no sound is perceived, and is again quickly shifted to the patient's mastoid process, and the number of seconds the vibrations are heard is recorded. If the patient hears the tuning fork after the examiner no longers hears it, it is believed that the patient's deafness is due to a defect of the sound conduction apparatus. One can readily see that this test is performed by hand and that the blow is not struck with the same force each time the test is executed; that there is no uniformity present, and the results therefore will not be accurate. Furthermore, the designation of the terms "positive and negative Schwabach" are at best approximate, as no record is made of the number of seconds negative or positive obtained; and it also might be that the otologist himself may have an early or advanced defective bone conduction at the very time he compares his bone conduction with that of the patient. I have learned by experimental work that the examiner's hand absorbs some of the vibrations especially if the fingers are located near the nodal point where the tuning fork is held. There is further inaccuracy on the patient's part, since the one being examined usually signals to the examiner by raising or lowering his hand which further entails some appreciable loss of time. These are some of the most important variations which I have noted, and from a scientific standpoint, I am sure will cause differences in reports from the otologic viewpoint.

Rinne Test

In the Rinne test, the tuning fork No. 256 D.V. usually employed is struck also by hand against various types of objects, at time forcefully and at times lightly; thus the prongs are set into vibration and the hilt is held

^{*} Read at the Fifteenth Annual Session of the American Congress of Physical Therapy, New York City, September 9, 1936.

first over the mastoid process until the patient can no longer hear the vibrations and then the prongs are placed just in front of the anterior auditory meatus, the patient is requested to signal by raising his hand when he no longer hears the tuning fork vibrations. The tuning fork, of course, is held in a vertical position opposite the ear examined, accordingly a subject with normal hearing power will hear the vibrations again after the tuning fork is taken away from the mastoid process and placed in front of the meatus; hence, his air conduction in this case is greater than his bone conduction, or AC is greater than BC. Usually the normal duration of air conduction is two times that compared to bone conduction, and with air conduction it is, as a general rule, a normal finding spoken of as a positive Rinne. If after the removal from the mastoid process there is no sensation of hearing from the vibrating fork, the steps in this case are reversed; hence, the tuning fork should be kept just in front of the anterior meatus until it is no longer heard, when the hilt should be placed against the mastoid bone. If in this stage the sound is heard, it is assumed that bone conduction is greater than air conduction, or BC is greater than AC. This test is termed as a negative Rinne.

Diagnostically the negative Rinne is obtained in disease of the sound conducting apparatus. Where there are pathologic conditions of the sound perceiving apparatus, it is found that air conduction is still greater than bone conduction. I have observed that a positive Rinne is not only obtained in the normal ear, but also where there are lesions of the sound perceiving mechanism. In the execution of this test there are also several inaccuracies, as are found in the performance of the Schwabach conduction test for the same reasons that the tuning fork is not accurately struck with the same force at each blow and that the timing element is totally ignored in this very important diagnostic test. Since it is important to know in the negative or positive Rinne how many seconds negative or positive are obtained, I feel that this test loses much of its diagnostic value because it is not accurately timed. Also the patient in raising his hand loses some time from the moment his perceptive mechanism works to the time he executes the act of raising his hand. Thus, the same reasons hold true for this as for the Schwabach test.

In the Weber Test it has been observed that when one ear is plugged, sound will be heard better in that ear, as vibration is heard better in an ear where there is a diseased process in the sound conduction mechanism than it is in an normal ear. On the other hand, if the deafness has been caused by the sound perceiving apparatus, the vibrations are heard better in the normal ear, and here again the accurate timing of the tuning fork in striking the blow uniformly is important. In following a series of cases where Schwabach and Rinne tests are to be performed at different intervals, perhaps over a period of several years, it is of great significance to know whether the variations of these tests as to timing and the uniformity of the stroke have changed.

The importance of the electro-acousto-testometer can be readily seen. With the aid of this apparatus the results obtained will always be constant as the striking of the tuning fork will be of the same force, it being controlled by an electro-magnet which is operated by the patient himself by using a push-button which is attached to the circuit. Not only does the stop-watch simultaneously record the actual time the sound is heard through bone conduction, but the patient himself, by means of another push-button, can stop the watch when he can no longer hear these vibrations either through bone conduction or by means of air conduction when the Rinne test is performed. The tuning does not have to be compared to the examiner's ear which might

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EDITORIALS

AMERICAN HEALTH RESORTS

It is with regret that we are constrained to call attention to the fact that in comparison to European spas our natural medical resources are, outside of a few noteworthy exceptions, lacking in proper exploitation on the part of the medical profession, through no fault of its own. It is an open secret that some highly advertised "sanatoria" built in the vicinity of certain mineral springs obtain their clientele not through the support of the medical profession but through direct appeals to the imagination of the lay public. The astonishing feature of this is the circumstance that the men financially interested in this class of enterprises are either too short-sighted or unwilling to realize that their "institutions" suffer not only from lack of prestige but inadequate material returns commensurate with the outlay in questionable propaganda.

It is generally known that year in year out discerning patients leave their American homes for sojourns in foreign spas, notably those of France and Czechoslovakia, and yet the directors of so-called American spas do not seek an answer to the question why their establishments are ignored. The handy "alibi" that Europe itself offers attractions does not stand critical analysis. The average American business man may go to Europe once or twice, but after that the novelty has worn off, and many business men would gladly save the time required for travel were they assured that they could obtain the same therapeutic benefits nearer home.

There is no gainsaying that Nature has been as lavish for America as for Europe so far as mineral springs are concerned. Even the much abused prescription of "change of environment" can be filled even more pleasantly within our own borders than abroad. But after all is said and done, it is not the small amount of chemicals contained in the diverse "kurorte" waters that plays the important therapeutic role. It is no secret that at least some

of the bottled waters sold in the open market and supposed to have been taken from certain springs are reinforced by the addition of chemicals. What is of importance is the circumstance that while patients take a "cure" in any resort, they are freed of the wear and tear of daily toil, and can devote every minute to a suitable dietetic and metabolic regime in connection with the beneficial influence of properly regulated relaxation and exercise and of other remedies that may be indicated in each individual patient.

At the very best monotherapy must remain as ineffective as it is unscientific in the overwhelming majority of instances. The physician who has only one favorite formula as his therapeutic stock in trade, the surgeon who treats any and all injuries by one and the same measure, and the physical therapist who is confident that one apparatus is adequate for all his patients, are unthinkable in modern medicine. Similarly each spa has only one type of water, which at best can have but a limited field of applicability. Something additional must be provided or else one of two things will be the result. Either the "spring" will remain an unknown quantity in American spas, or else there will be merely "visitors" or "guests," like so many country boarding houses catering to those seeking escape from the city during their summer vacations, but no patients.

We have already alluded to the fact that there are noteworthy exceptions. From time to time the Archives has published scientific articles from men associated with health resorts of splendid repute. These resorts have the whole-hearted support of the medical profession, not because they have exceptional natural resources or more luxurious accommodations, but because their medical staffs are composed of men of high professional ideals and scientific attainments, who are thoroughly familiar with the proper indications and also limitations of the available natural remedial resources.

Compare with this the methods of the owners of certain sanatoria that would not be accepted even as hotels by those who take pride in that public utility, and we see that instead of scientific publications intended for the medical profession they find it more convenient and profitable to flood the country with blatant claims in the form of printed advertisements and radio announcements aimed at securing patronage from gullible yokels. What difference other than in degree is there between the method of the itinerant medicine man drawing a crowd of villagers by a cheap vaudeville act in order to sell them some useless concoction asserted to be good for "man or beast" and as capable of "growing hair as to stop ague," and the advertising methods of certain "springs"? When so conservative, benevolent and authoritative a clinician as Bernard Fantus,* of the University of Illinois, is compelled to characterize a rather popular resort in the middle west as "the lowest level of medical respectability," then there is something decidedly wrong.

Organized medicine, as embodied by the American Medical Association, has formulated a code of ethics. Here and there a black sheep among graduates in medicine may defy the authority of that great national body, and resort to questionable business methods in order to enrich himself at the expense of legitimate medical practitioners, but in the long run such men out of the fold live to regret their misspent lives and to curse their ill-gotten lucre. What applies to individuals, some of whom may have been unfortunate rather than ill-intentioned, certainly applies with equal if not greater force to institutions supposed to serve the interests of patients. They may defy the restrictions imposed by the American Medical Associations and rely upon unethical methods to fill their coffers, but they will find that eventually

^{*} Fantus, Bernard: Personal Communication.

scientific endeavor will prevail while charlatanry sooner or later will have to reap its own reward. That this is not an idle phrase is already evident from the fact that the scientific resorts are compelled to maintain waiting lists solely through the support of the medical profession, while the other type of hotel-resorts must continue to invest large sums in advertising propaganda to prevent many of their rooms from being unoccupied.

We, who are especially interested in scientific balneology, hydrotherapy and the natural treatment of certain diseases, will keep agitating this problem of American spas until the majority of concerned establishments will make an earnest effort to be more than mere money-making enterprises.

THE PROGRAM OF THE 16TH ANNUAL MEETING

Elsewhere in this issue is published the preliminary program for the next annual meeting of the Congress to be held September 20 to 24 inclusive, in Cincinnati, Ohio. The onerous task of arranging the diversified program of special addresses, conferences, seminars, scientific and technical exhibits is virtually completed, all that remains being the actual demonstration of the high standard which the 16th annual session is certain to attain.

Attention is invited to the morning sessions of the second and third days, which will be sectional meetings for conferences and seminars. It is planned that they should prove instructive to those members and visiting physicians who are especially interested in the technical subjects provided in the program.

The general sessions will be devoted to symposia on important and timely subjects which should prove particularly valuable to those engaged in general practice. Great care has been taken to select as speakers men whose special attainments qualify them to present the fruits of both clinical and laboratory research.

As was pointed out in the preceding issue, the Congress is to be felicitated this year for having secured as guest speakers several distinguished foreign workers. Reference to the program will reveal the value of the messages they have crossed the Atlantic to deliver to the American medical profession through the medium of the Congress. It is indeed doubtful if this opportunity to hear some of the foremost European clinicians and investigators will again be had for some time to come.

The list of scientific exhibitors has grown from year to year. Elaborate arrangements have been made for the display of the latest models of apparatus, instruments and general equipment required for the effective practice of physical medicine and electrosurgery.

A cordial invitation is extended to all ethical physicians, medical students, medical technologists and nurses to attend the scientific sessions and visit both the scientific and the technical exhibits. There will be no registration fee.

It is hardly necessary to stress the fact that Cincinnati is centrally located, so that it can be reached even by motor from considerable distances of our land. It is suggested that visiting physicians bring with them their families, who are sure to enjoy this brief vacation in an attractive environment. But above all every physician who takes an earnest interest in the manifold problems of physical medicine or in the special application of physical agencies in the surgical specialties should avail himself of the opportunity afforded by the forthcoming convention, because it is not likely to be duplicated in clinical information in the near future.

NETHERLAND PLAZA — HEADQUARTERS FOR CINCINNATI CONVENTION

The Netherland Plaza Hotel has been selected as the official headquarters for all the sessions and exhibits. Very few hotels in this country afford such splendid facilities for small and large meetings and for technical and scientific exhibits. The structure itself is beautiful, spacious and conveniently located. The guest rooms are well appointed and reasonable in price. Good food at popular prices is served in several dining rooms and in the coffee shop.

Those who enjoy comfort in connection with a pleasant vacation and profitable study, should spend the week of September 20th in Cincinnati at the Netherland Plaza. It is earnestly requested that reservations should be made without delay in order to secure the most desirable accommodations. Again we urge all who contemplate attending the convention to communicate with the hotel — direct — specifying the type of rooms desired. Requests will be answered promptly by the management of this splendid hostelry.

EXAMINATION OF PHYSICAL THERAPY TECHNICIANS

The next technicians' examination for certification by the American Registry of Physical Therapy Technicians will be held on Monday, September 20, at 9 A. M. in Parlors A. B. C. D. Netherland Plaza Hotel, Cincinnati. The examination is being conducted in connection with the sixteenth annual scientific session of the American Congress of Physical Therapy. Technicians who are qualified and desire to take the examination should make application not later than September 8. Application forms may be had from the Registrar, Marion G. Smith, care of American Registry of Physical Therapy Technicians, 30 North Michigan Avenue, Chicago. No applicant will be permitted to take the examination whose authorized credentials and medical references are not filed with the Registrar.

The examining board reserves the right to submit a candidate to written and practical tests. The board will, however, take into consideration such factors as (1) educational background, (2) technical schooling, (3) practical training, (4) experience, and (5) supervision in private and hospital practice.

THE STUDENT'S LIBRARY

CHRONIC RHEUMATIC DISEASES. Third Annual Report of the British Committee on Chronic Rheumatic Diseases. Edited by C. W. Buckley, M.D., F.R.C.P. Cloth. Pp. 132. Price 10s. 6 d. London: H. K. Lewis & Co., Ltd., 1937.

This third report presents the recent clinical and laboratory observation and research on chronic rheumatic diseases performed in the British Empire. There are interesting articles on vaccines, sympathectomy, x-ray therapy, vitamins and chronic arthritis. Dr. Hench has contributed a synopsis of the recent American investigations in this group of diseases and there are also reviews of the French, German and Italian literature. Official statistics of the British Empire show that rheumatic disease is the most serious of all maladies affecting the economic life of the community. This volume presents some excellent research work to broaden our knowledge in relation to causative factors and useful remedies. It is of interest to all who are called upon to treat chronic rheumatic diseases.

TEXTBOOK OF GENERAL SURGERY. By Warren H. Cole, M.D., F.A.C.S., Professor of Surgery, University of Illinois College of Medicine, and Robert Ellman, M.D., Associate Professor of Surgery, Washington University School of Medicine, St. Louis. Cloth. Pp. 1031 with 559 illustrations. Price, \$10.00. New York and London: D. Appleton-Century Co., 1937.

This work is the outgrowth of notes used in the teaching of junior and senior classes at the Washington University medical school. The revised mimtographed assignments of the formal lectures in surgery, together with those used for students in the out-patient surgical clinic and the material prepared for the course in surgical pathology form the basis of this work. It differs to a certain extent in the selection of material and because of the emphasis of the subject matter on the physiologic point of view. The authors have stressed the pathgenesis of the various disabilities discussed in order to bring into sharper relief the rationale of treatment. One also notes a departure from the usual style of presenting surgical topics for teachpurposes. Here one observes a detail of decription for non-operative therapy and less so for perative technic. The authors have adhered to this m of discussion because they have felt that space as too valuable to repeat in detail description of crations which could be found in specially preared text. Instead, there has been incorporated a eater detail into the illustrations, legends and case stories. Greater space and more complete exsition has been devoted to the management of ounds and to the surgical treatment of the endone glands. One notes with regret that no menon is made of the status of electrosurgery in malignant diseases, its increasing employment in the pathologic prostate, or its preferred use in brain lesions. The volume is not free from typographical errors although they are at a minimum. One encounters the unwelcome irritation of contributors supposedly listed in the index but absent on the page quoted. As an example, one finds the name of Ellis referred to page 120 but not included on that page. The work includes a bibliography, well represented with authoritative contributions, and contains a laudatory foreword by Evarts A. Graham to whom this volume is dedicated.

THE PHYSIOLOGICAL BASIS OF MEDICAL PRACTICE. A University of Toronto Text in Applied Physiology. By Charles Herbert Best, M.A., M.D., etc., Professor and Head of Department of Physiology, University of Toronto, and Norman Burke Taylor, M.D., etc., Professor of Physiology, University of Toronto. Cloth. Pp. 1684 with 399 illustrations and tables. Price, \$10.00. Baltimore: Wm. Wood & Co., 1937.

This book endeavors to bring closer the laboratory findings of the physiologist for the benefit of the clinician and his bedside problems. It has attempted to divest physiology of its academic mantle and bring the practical discoveries and interpretations of the laboratory worker to the physician and his patient. Accordingly the authors have attempted to span the gap between theory and practice by emphasizing and pointing out "those aspects of the subject which will throw light upon disorders of function . . . and in this way play a part in giving the student and practitioner a vantage point from which he may gain a rational view of pathological process-In contrast to past teaching in which emphasis was placed on animal research and experimentation on morbid anatomy, the authors explain that the student of scientific medicine is directing his attention more than ever before to the study of morbid physiology in his search for the solution of many of his clinical problems. The objective of this work is to correlate theory and practice by enlisting the interest of the physiologist and physiologic chemist into pathways of interpretation for the quicker and better solution of clinical problems. The volume is divided into eight large sections, which in turn are subdivided into 73 chapters. It reviews in detail the morbid physiology and the clinical disturbances of the blood and lymph; the circulation of the blood - its dynamics, pressure, cardiac cycle, electrocardiography, and the like; the physiology and clinical manifestations of respiration; the excretion of urine and the physiology of kidney disease; digestion and its interpretation; the role of metabolism and nutrition; the ductless glands and the nervous system. One need but glance through the voluminous literature (100

pages) appended under the section of References to appreciate the encyclopedic character of this work and the tremendous labor involved. Undoubtedly this book will long be utilized as an important contribution and authoritative guide on the physiologic basis of medical practice. This book belongs to the 'must' publications required of every progressive physician to possess as an invaluable reference to clinical practice.

DIGESTION AND HEALTH. By Walter B. Cannon, George Higginson Professor of Physiology, Harvard Medical School. Cloth. Pp. 160 with 14 illustrations. Price, \$2.00. New York: W. W. Norton & Co., 1936.

This internationally known physiologist summarizes his forty years of extensive study and experience with reference to the ways in which the appetite, hunger, thirst, and emotional excitement affect the digestive mechanism and how this infiuences the health of the individual. Written in a simple, non-technical style in order to reach the greatest number of readers, Dr. Cannon reviews the many problems, the struggle for recognition and the slow acceptance of certain basic facts related to the physiology of digestion and its influence on the health of society. He supports the contention of Benjamin Disraeli, that the health of a people is the foundation upon which rests all their happiness and their power as a state. America was proud to celebrate in 1933 the centennial of the book by William Beaumont, a Connecticut Yankee who was the first pioneer American physiologist to employ the laboratory method in his study of the action of gastric juice obtained through a permanent fistula of a patient, named Alexis St. Martin. Due to the fortuitous circumstance of having delivered the "Beaumont Lectures" at the centennial celebration in 1933, the author enlarged his notes to form the basis of this informal discussion. It includes within the space of four chapters an introduction and epilogue, a review of the nature of appetite and hunger; the nature of thirst; a consideration of digestion and bodily vigor; and a summary of the factors influencing indigestion from pain, worry and excitement. The index is a very practical section of interest to all. The fact that this small volume emanates from the experiences of one of the foremost physiologists in America and has been written in such an informal style by an outstanding authority on the subject, is sufficient reason for its recommendation. Its reading will form a delightful period in one's experience.

AN INDEX OF DIFFERENTIAL DIAGNOSIS OF MAIN SYMPTOMS. By Various Writers. Edited by Herbert French, C.V.O., C.B.E., M.A., M.D., Oxon., F.R.C.P. Lond, Consulting Physician to Guy's Hospital; late Physician to H. M. Household. Fifth Edition. Cloth. Pp. 1145 with 742 illustrations. Price \$16.00. Baltimore: William Wood and Company, 1936.

This treatise on the utilization of all the main signs and symptoms of diseases for differential diagnosis has evidently served a useful purpose, as

it has now reached its fifth edition. It is of practical use to the general practitioner in deciding the diagnostic significance of particular symptoms. While the data on the various symptoms are arranged in alphabetical order, the work to all intents and purposes actually is one on differential diagnosis because it discusses the methods of distinguishing between the various diseases in which each individual symptom may be observed. This is a companion book to the "Index of Treatment" by the same publishers for which reason treatment is not considered in the present volume.

ELECTROCARDIOGRAPHY. By Chauncey C. Maher, B.S., M.D., Assistant Professor of Medicine, Northwestern University and the Montgomery Ward Medical Clinics, Attending Internist at the Cook County Infirmary and the Cook County Hospital and the Passavant Memorial Hospital, Chicago, Illinois, Cloth. Pp. 254. Price \$4.00. Second Edition. Baltimore: William Wood and Company, 1937.

This new edition includes the advances made in electrocardiography in the last few years, as a standard part of cardiovascular diagnosis. The author believes that the method is most useful when the electrocardiogram is interpreted as a part of the entire clinical picture. This treatise has been prepared for the general practitioner and the medical students so that they may appreciate the value of the electrocardiogram in the diagnosis of heart disease and learn to correlate the electrocardiographic findings with their clinical data. The text is concise, authoritative and brought down to date. It is recommended to all general practitioners as a reliable guide in the work for which it is indicated.

DAS HEUFIEBER UND SEINE BEHAND-LUNG. Von Erich Urbach, Primararzt der Allergisch-Dermatologischen Abteilung am Krankenhause der Wiener Kaufmannschaft; Privatdozent für Dermatologie an der Universität Wien. With 83 partly colored illustrations, 6 plates and 21 tables. Cloth. Pp. 180. Price, Rm. 12.00. Vienna: Wilhelm Maudrich (American Agency: Chicago Medical Book Co., Chicago), 1937.

In this book Urbach presents the problem of hay fever and its treatment in a more detailed manner than in his large text-book on allergy, which was favorably reviewed in the Archives. The book contains certain features not encountered in similar monographs in the form of innovations originated by the author, namely, a harmless diagnostic test of nasal pollen sensitivity and suggestions for a new biologic therapy with altered plant albumin. The book is systematically arranged to cover every known problem. Zinc ionization, with which many American workers have obtained excellent results at least in a palliative sense, does not receive the hearty approval of the author. Franz Berger, of Vienna, has contributed several chapters on the botanical aspect of hay fever. Those interested in the study and therapy of hay fever will find many interesting data, especially with regard to the production of allergen extracts.

Electro-Acousto Testometer - Kafka

(Continued from page 508)

be diseased or defective, as the mean average of the number of the vibrations is already recorded for normal.

807 St. Marks Avenue.

Discussion of Papers of Drs. Ersner and Kafka

Dr. J. I. Klepper (New York): The standardized tuning forks still hold a very important place with the average specialist. First, because he is accustomed to them and they talk to him in a language on which his past experience has been based. They have helped him in the past in the diagnosis and treatment and in choosing methods of operations. The audiometer makes records in which the personal element of the examiner and of the patient is done away with in a major part. It is more accurate in the registration of pitch and intensity or loudness and goes above the normal hearing and below it. We have not yet been con-verted to the idea of discarding the tuning forks, because we would miss a very powerful diagnostic means of distinction between bone and air conduction, as exemplified in the Rinne test.

The audiometer is probably a most distinct advance after Bezold's tuning forks as a means, nearly exactly, of measuring intensity and pitch of sounds, the calibration and registration of which are usually missed by tuning forks. It is probably the best instrument for experimenting and recording, for industrial purposes as well as for testing school children and also for medico-legal work. The audiometer is still in the process of development and cannot completely take the

place of the tuning forks.

Speech as a means of testing still has some value, as the patient is ultimately interested in speech as determining his own deafness.

The audiometer is a very valuable instrument for higher or lower tones than the normal range of tuning forks; it may even occasionally replace the tuning forks in finding islands of lapse of hearing. It is a very valuable instrument for experimental purposes.

Dr. J. H. Hulka (New York): When we test hearing we are interested in four principal things: We want a certain degree of accuracy. We want to have something which is convenient to use. We want to have some kind of a record, and we want to have the tests uniform or standardized.

From these standpoints we should consider the two instruments, the tuning fork and the audiometer. The tragedy of the tuning fork is that we cannot have both accuracy and convenience. The tuning fork necessitates a trained observer, soundproof conditions and a standard stroke. With this standard stroke in a sound proof condition, six measurements with tuning fork 256 are taken, namely 67 seconds. 65 seconds, 68 seconds, 70 seconds. 65 seconds, and 65 seconds.

Without precautions I have a difference between 70 and 65. That is 5 econds.

Taking a stroke which is not standard which is very convenient against the patella, six measurements — 69, 65, 65, 68, 67 and 63 are used.

67 and 63 are used.

You have six measurements. How long did the fork sound? You take an average from six measurements. You get a total of 400 seconds, divided by 6, 66.66 seconds. That is the average and the probable truth in this problem. If you do not have a standard stroke, you have a total of 397 divided by 6. That gives an average of 66.18. There is the difference between standard stroke and non-standard stroke. That is the element of error between 0.18 and 0.66. There are evidently some other defects in tuning fork tests which enlarge that error.

With the standard stroke there is a maximum difference of 5 seconds if I am the observer. If I take my secretary, a young girl, trained observer doing a lot of tests for me, I get a difference of about 10, a maximum difference on several tests. The average is about maximum difference.

These tests were done between twelve and three at night in an inside room. If I test myself in a room which is not sound proof, under average acoustic conditions of my office my test is about 12 maximum difference between those two.

If I take an average patient with all the precautions of the standard test, I get as much as 20 seconds difference. Naturally, if you take more than six tests — if you want to have the same accuracy in a room that is not sound proof, with an average patient, you have to take more than six tests. You get the same average, but you have to take more tests. You climinate the large errors and you have to take, say, fifteen or twenty tests. Then you have accuracy, but not convenience. If you have convenience and do only one stroke, you have on the average patient, 67 plus, minus 10, because the total variation is 20.

How does the audiometer overcome this? If we measure a tone which varies in intensity, we can represent a tone by a figure. We have a loud and a very weak tone, the average being the threshold. Naturally with a sound which is gradually decreasing, the points are dispersed. The audiometer is calibrated in steps of five units. Instead of a continuous, smooth line it goes in steps, and if you use proper technic on the audiometer and let the patient signal when he begins to hear, then he hits one of the steps. It is much easier to hit a certain definite step than to hit a definite point on a continuous line. That is how accuracy is

attained in audiometric testing. Besides that, you have convenience — that of a

telephone receiver.

You can make audiograms in seconds or sensation units or where the sensation unit equals the decibel, or one hundred sensation units equal one hundred and twenty decibels. You always will get a certain curve if you plot it. Of course, each will be different. If you record in seconds, it will be absolutely different than if you record in sensation units.

Dr. A. Spencer Kaufman (Philadelphia): The work that has been done in the last few years toward the increased accuracy in the testing of hearing has been a step forward. For years we accepted the pathologic basis, classification and tests laid down by the pioncers in otology. This in time to come will change considerably. Just where the conducting apparatus disease ends and the perceptive apparatus disease begins will be more definitely and scientifically gauged.

With the increase in the scientific testing of hearing we can more accurately find the loss of hearing in individual cases, under our present understanding of deafness. It is not putting the cart before the horse to get at these tests before increasing our knowledge of the pathology of deafness because as that develops it is a simple matter to apply it to hearing in a pathologic sense.

Dr. Ersner spoke of the soundproof room. It is almost impossible to get a soundproof room constructed in a building, but we can attain a fair degree of

quiet.

As far as the comparative value of tuning fork and audiometer is concerned, I do not believe there is any question that the audiometer today far surpasses the tuning fork, particularly in the recording

and making of graphs.

As to Dr. Kafka's apparatus, it is one I am entirely unfamiliar with, except from the literature, as it appeared some time ago and was emphasized this morning. The relative amount or intensity of bone conduction, of course, varies with the consistency of the skull, the amount of padding or insulation formed by the subcutaneous structures.

In some instances you will have the hilt of the tuning fork down practically on the mastoid, with only a thin layer of skin intervening, and in other cases the patient may be pretty well padded.

I like the idea of this apparatus very much. I have always felt that the proper way to get the Schwabach test is to time it. I have always timed it, using a stop watch. Discrepancies may arise from the time the patient feels the vibrations or has ceased to hear them, and indicates it either by raising his hand or by word of mouth. Nevertheless, up to the present time, as far as I am concerned, that has been my most accurate way of taking bone conduction.

Dr. John Guttman (Brooklyn): About sixteen years ago, before any other method was devised, I suggested having the audiometer made, which was a decided advantage. In order to know the pathologic basis of hearing defects we must know how an ear acts normally. When we know physiology we know we can learn the pathology and then possibly come to the method of treatment.

The reason we accomplish practically nothing in the way of treatment, is because we do not know the nature of the lesion

The statement about sound ducting, sound perceiving apparatus mentioned by Dr. Kaufman, is right. anybody tell me where sound conducting apparatus ends and sound perceiving apparatus begins? Some say it is the lymph fluid. Others say it is the sensory epi-thelium of Corti's organ. The latest paper of Wittmark, in Hamburg, proclaims the sensory apparatus of Corti's organ, Hair cells are nothing but ordinary epithelium which has nothing to do with the perception of sound. That would certainly contradict all former conceptions that the vibrations act from the middle car, to Corti's organ, over to the nerve, and so on, to the brain. The epithelial hair cells of Corti's organ belong to sound conducting apparatus. The nerve is a conductor. What else can one expect of a nerve? You have the sound conducta nerve? You have the sound conducting end. Where does it end? Probably in the brain.

According to the latest study on the physiology of hearing in animals, every nerve impulse is accompanied by a demonstrable electrical change. This helps somewhat. When you have a change in the electrical conductance that you can demonstrate on a voltmeter, you know there is a nerve impulse. It is a great advance in the study of the ear.

Dr. Matthew S. Ersner (closing): I believe that for every-day diagnosis we

could utilize the tuning fork.

In reference to the audiometer, we observed a patient who had an exenterated labyrinth. It dawned on us that the audiometer is not altogether correct, that we were borrowing hearing from the good side. One of the things about which we sometimes must be careful with tuning forks is not to borrow from the good side. We must damper those ears with some apparatus.

We perhaps can do something in the acute catarrhal obstructive deafness, with the hope we may open the custachian tube, release some adhesions in the middle ear, and relieve the patient.

When we are dealing with the chronic catarrhal conditions or the mixed type, we are at a loss, and it is a question whether we should treat the patients the way we do today. We are primarily aiming at opening the eustachian tube, but if we study its physiology we find that with the middle ear it constitutes a sort of double drum. We all know what we have in otosclerosis, yet we use the catheter to ventilate the inner ear.

I do not think we ought to have standardized tuning forks, for it is difficult to

standardize tuning forks even from the

There is no doubt Dr. Hulka has an ingenious idea, striking the fork with a definite pendulum. I have a long metal handle with a rubber tube that hangs on a string. I keep the fork in a certain place, lift the handle at an angle of 45 degrees, and let it go. There is very little variation if I carry it out that way.

The audiometer aims at standardization and I am sure that sooner or later, with the improvement in the vacuum tube and radio tube, we are going to accomplish a great deal. We will be able to standardize also the artificial hearing aids. It won't be necessary to carry a burden on our shoulders with large apparatus.

In regard to tinnitus, that is a problem and it is difficult to test such an individual's hearing. The future audiometer with its attenuator will be important because it will measure the amount of electrical energy put into the apparatus. We will have to reckon with the receiver output for each frequency and for the intensity, and just as soon as we will take that into account and standardize all receivers, and the audiometer with the attenuator, there will be an even amount of pressure going out and transmitted to that receiver.

Fletcher's rule was wonderful because what he brought to us is the point where a tone or sound cannot be heard. We do not care how much we can hear. It is the point where you hear it less. We need that type of audiometer and that type of receiver or ear piece so as to transmit it, and once we accomplish that, we will have a standard audiometer.

Dr. M. Martyn Kafka (closing): In regard to the tuning fork examination, I will say there is an element of error at times, particularly with the "Rinne" and "modified Rinne" where one gets decreased bone and air conduction, and "Rinne imaginaire" implying a sensation that they hear, which actually they do with the opposite side.

On the question of standardization, we know that every tuning fork on the market, if the manufacturer is one who is recognized, must meet the regulation set forth by the United States Bureau of Standards in weights and measures and sounds, and that it usually meets certain standards.

Each tuning fork rarely loses, after it is standardized, the actual value of vibration, because according to the law of physics it is a vibrating rod and these rods will vibrate whether put in a straight line or bent over as a tuning fork is.

I cannot go into the question of the difference between the tuning fork and audiometer, since it is out of my field, but I will say unless, as Dr. Ersner stated, the audiometer is actually standardized so that in Los Angeles and New York and up North and in the South when a man using the audiometer uses it with the same understanding, it is not a reliable apparatus.

I feel that the tuning fork today, because of its price and because of its convenience of use, should be more utilized by otologists, but that the idea of using it should be with a uniform stroke and with precision, and definite records being made of the tuning fork.

Evaluation of Roentgen Rays in the Treatment of Chronic Nose and Throat Infections — Stevens

(Continued from page 478)

Technic

In skilled hands the technic is comparatively simple. The rays are applied at each sitting through two areas, one over the left side of the neck and one over the right side. The radiations are never applied through the open mouth nor is any apparatus ever placed within the throat through the mouth. Using the over-table type of holder, the patient lying upon his face with the head turned to one side, the beam of the roentgen ray is directed from behind the angle of the lower jaw, downward through the tonsil, the ray finally passing into the nasal accessory sinuses. The rays used are created with 4 milliamperes of current and 140,000 volts. With these factors the rays are passed through 0.1 millimeter of copper and 3 millimeters of aluminum and finally into the patient who is placed 30 centimeters from the target of the roentgen ray tube. The apparatus is allowed to run until 200 roentgen units are given. Upon the completion of another like treatment over the opposite side of the neck, the patient is said to have received one series of treatments. It is seldom necessary to give more than 8-10 such series of treatments to produce the desired result except when there are complications present. When the sinuses are involved, a third port is taken from the face surface of the head. The rays in this treatment are directed so that they will pass through all of the nasal accessory sinuses.

745 Fifth Avenue.

INTERNATIONAL ABSTRACTS

Fever Therapy for Subacute Bacterial Endocarditis. T. J. Dry and F. A. Willius.

Proc. Staff Meet., Mayo Clinic 12:321 (May 26) 1937.

The development of subacute bacterial endocarditis in an individual with a healed rheumatic endocarditis or a congenital cardiac lesion is a tragedy, especially when such conditions are otherwise compatible with a useful, if not a normal existence and a reasonable expectancy of life. If the diagnosis is correct and the organism responsible is the streptococcus viridans, as it is in fully 98 per cent of cases, the prognosis is hopeless. In the cases of reputed cures the criteria requisite for an unequivocal diagnosis of bacterial endocarditis have not been present.

Four patients with proved subacute bacterial endocarditis have been treated. The leukocyte responses in some of these cases were the subject of careful study while treatment was being given. In three cases the disease was engrafted on an old healed rheumatic endocarditis, while in the fourth, a diagnosis of patent ductus Botalli was made. Our patient presented evidence of mild myocardial failure, but the others had been in good health and had been living a life of unrestricted activity prior to the onset of the bacterial endocarditis. A green-producing streptococcus was isolated from the blood stream repeatedly in every case.

Treatments were conducted in a Kettering hypertherm, the height of fever being maintained at 106-107 degrees F. in four periods lasting from 3 to 5 hours each, in each case except one, in which case the patient had 6 sessions.

The late results are that one patient lived for ten months after dismissal; the others did not survive even three months. In every instance petechiae appeared after treatment, or became more prominent if they had been present before. Fever therapy must therefore be relegated to an already long list of discarded measures which are completely ineffective in the treatment of subacute bacterial endocarditis resulting from streptococcus viridans.

New Therapy of Essential Hypertension. H. Rutenbeck.

Klin. Wchnschr. 15:1920 (Dec. 26) 1936.

Rutenbeck describes craniocerebral electrophoresis as the new treatment for essential hypertension. He shows that craniocerebral electrophoresis produces a reflex hyperemia of the brain. The substance he uses is a choline derivative and the maximum current strength is 1.5 milliamperes. With such low intensities, burns are avoided. The treatments, lasting about one hour each, are repeated every day or every second day. The author employed the method with good results in those cases of essential hypertension in which treatment was required on account of headaches and vertigo. He does not consider treatment necessary in all cases of hypertension. — Abstr. J. A. M. A. 15:1920 (Dec. 26) 1936.

Cervical Infections and Electrocoagulation. Inglis F. Frost.

Am. J. Surg. 34:221, 1936.

The actual cautery has not given satisfactory results. Its action depends on heat, and frequently causes carbonization and burning of the tissues with resultant sear formation. It is also not without danger because of the possibility of latent hemorrhage. Electrocoagulation has won for itself a deserved place in the treatment of cervical disease. It not only restores a badly diseased cervix to as nearly a normal condition as is possible, but does so without scar formation. Electrocoagulation does not carbonize, its immediate thermal effect being penetration of the tissues with resultant thrombosis of the vessels and necrosis of the proliferating cells. It also dehydrates the tissues and by the heat generated causes sterilization which extends much further than the visible coagulated area.

To ascertain the type of healing by coagulation, several cases were treated prior to vaginal hysterectomy. These specimens were examined pathologically and in no case was it possible to detect scar formation in the stroma underlying the new stratified squamous epithelium.

Not only is electrocoagulation valuable in restoring a diseased cervix, but as an adjunct to pelvic surgery it has an important place.

Coagulation is contraindicated in the presence of any pelvic infection but may, in selected cases, be used in prenatal work up to the third month.

It is a decided help, prior to coagulating, to use Lugol's solution swabbed over the surface of the cervix, inasmuch as it marks the contrast between diseased and normal tissue.

It is important that coagulation should be performed during the intermenstural period, that is, after the first week following the period and never later than five days prior to the next.

The presence of mucus in the canal often makes it difficult to obtain a satisfactory coagulum. This may be overcome by swabbing the cervix with caroid powder or sodium perborate. Following the treatment, the patient should be warned that there will be a profuse watery discharge. An alkaline douche will do much to make the patient more comfortable.

In coagulation, it is a better practice to begin with the canal and treat the endocervicitis first, otherwise there is danger of obstructing the cervical opening. There is also a further advantage, in that the surface will be smaller in size and much of the edema and hypertrophy will be reduced.

There are few cases of endocervicitis or croded cervices which will not respond to electrocoagula-

tion.

Transurethral Prostatic Resection. Gershom J. Thompson.

Pennsylvania M. J. 40:411, 1937.

The criticism has been made that electrocoagulation incident to operation results in wide destruction of tissue left in situ; consequently, toxemia and severe dysuria are inevitable when this slough separates. Such reactions are due to lack of familiarity with the equipment employed at operation. Although it has seemed at times that excision of tissue with a cold knife is followed by fewer febrile episodes than follow operation with the electric loop, this may be a false impression. If experience with all the various types of instruments is equal, the reaction from operation and results from their use are perhaps identical. In a comparative series any difference in morbidity and mortality can probably be explained by factors other than the type of instrument employed. Factors such as careless postoperative management and the lack of adherence to aseptic precaution are perhaps of greater significance than the type of resectoscope chosen.

Sufficient tissue should be excised to insure an adequate funnel in the vesical neck. If this cannot be accomplished in one operation, a second operation should be performed at a later date. A false idea prevails that resection of only enough tissue to form a gutter through the prostatic urethra will result in a complete restoration of function. This is distinctly a misconception, complete removal of all intravesical tissue being desirable, together with removal of varying amounts of tissue from the intraurethral portion of the gland. Thus uniformly good results will be insured. Operation in several stages will be necessary during the surgeon's early experience. The author has resected 100 gm. of tissue at a single operation, which lasted 70 minutes. However, in the majority of cases the removal of such a large amount of tissue is neither necessary nor desirable, for such huge glands are rarely encountered.

The most important postoperative factor is insurance of adequate drainage. Following suprapubic prostatectomy, occlusion of the drainage tube was never a serious matter, for urine would escape alongside the tube without the production of unusual distention of the bladder. Following transperthral resection, however, occlusion of the urethral rapidly lead to overdistention of the bladder. This will be followed by efforts to void alongside the tube, subsequent fever and chills being caused by the urethral distention.

Many authors contend that mortality following transurethral prostatic resection is little if any less han that which occurs following other types of prostatectomy. This must be accounted for by relative inexperience with transurethral surgery. It is not unreasonable to expect a very considerable re-

duction in mortality rate. At the Mayo Clinic in a group of 1987 patients, whose average age was higher than that of an equal number subjected to suprapubic prostatectomy in former years, 2296 transurethral resections have been performed in the interval from Jan. 1, 1932, to Jan. 1, 1936, with only 14 deaths or a mortality of 0.70 per cent. This rate is much lower than was ever before experienced subsequent to either suprapubic or perineal prostatectomy.

Ingestion of Vitamins A, B, C and D and Poliomyelitis. John A. Toomey.

Am. J. Dis. Chil. 53:1202 (May) 1937.

Some investigators have expressed the opinion that protection against poliomyelitis is a maturation phenomenon. Others have stated the belief that protection bears some relation to the physical makeup of the human being. Some of the histories of cases of poliomyelitis suggest a correlation between the lack of certain vitamins and resistance to the disease. It was decided that before experimentation was done with diets deficient in vitamins, it should be determined if the feeding of large amounts of vitamins would have any effect on protection. The experiments showed that the ingestion of vitamin D protects Macacus rhesus monkeys from poliomyelitis when the virus is subsequently introduced by way of the gastro-intestinal tract. Lack of vitamin D in the routine diet makes the animal more susceptible to the disease when the virus is given by way of the gastro-intestinal tract. Animals may be given such diets and so prepared that poliomyelitis can later be produced merely by introducing the virus into the gastro-intestinal tract.

Ionization and Allergy. A. M. Alden.

Laryngoscope 47:17 (Jan.) 1937.

Alden points out that ionization in no way alters the fundamental physiologic characteristics of the individual which make him allergic, and that it even decreases for only a relatively short time the ability of the nasal cells to combine with and be affected by their offending allergens. What it does is, by a mechanical change, to render the nasal mucosa less able to produce disagreeable obstructive and secretory symptoms in response to either external irritation or vasomotor stimuli. Desensitization is still the method of choice in the treatment of this condition, ionization being reserved for patients in whom the obstructive and secretory symptoms are predominant and in which the mechanical relief to be expected is more than commensurate with the tissue damage incident to the ionization. Asthma has not been lessened after ionization except in a few cases, in which the author is sure that the improvement was due to the relief from nasal obstruction rather than to any change which the treatment brought about in the allergic status of the patient. — Abst. J. A. M. A. 108:1142 (March 27) 1937.

ANNOUNCEMENT and PRELIMINARY PROGRAM

SIXTEENTH ANNUAL SCIENTIFIC SESSION American Congress of Physical Therapy

SEPTEMBER 20, 21, 22, 23, 24, 1937

Netherland Plaza Hotel Cincinnati

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RULES GOVERNING THE READING OF PAPERS

AND DISCUSSIONS

No address or paper before the Congress shall occupy more than twenty minutes in its delivery and no member shall speak more than five minutes or more than one time on any one subject, provided, each essayist be allowed three minutes in which to close the discussion. This rule must be strictly adhered to.

All papers read before the Congress shall be the property of the Congress for publication in the official journal. Each paper shall be deposited with the Secretary of the Section when read.

No paper shall be published except upon read.

when read.

No paper shall be published except upon recommendation of the Publication Committee.

GENERAL INFORMATION

While the 16th annual session officially opens for registration on Monday morning, September 20, the formal opening of the Congress will not take place until Monday evening. The regular scientific sessions begin on Tuesday morning, September 21 (See schedule of daily activities).

REGISTRATION is required of all members and guests as no one will be admitted to any of the conferences or lectures without proper identification. There will be no registration for

without proper identification. There will be no registration fee.

The EDUCATIONAL CONFERENCE will be held on Thursday evening, September 23, and should prove of unusual interest to teachers, technicians and others concerned in the training for physical therapy.

The program proper begins with the CLINICAL CONFERENCE GROUPS on Tuesday morning, September 21. It is not intended to have a large attendance at these sessions as they have been planned primarily for the purpose of didactic instruction without, however, the formality of the latter. Every specialty is duly represented so that those who are interested only in certain specialties may arrange their time to the best advantage.

SCIENTIFIC AND TECHNICAL EXHIBITS

Every one attending the sessions is urged to inspect the technical and scientific exhibits. These have been arranged with great care and should prove of unusual interest. The number of scientific exhibits has been greatly augmented this year. Suitable awards in the form of medals and certificates will be announced at the annual dinner on Wednesday, September 22. Announcement of gold key awards will also be made on this occasion.

THE ANNUAL DINNER

The annual Congress dinner will be held on Wednesday evening, September 22. Members, exhibitors, guests and their ladies are urged to secure their dinner tickets when registering. A splendid program has been arranged for this social function.

SCHEDULE OF DAILY ACTIVITIES 16th Annual Session

SUNDAY, September 19

12 Noon. Luncheon — Executive Session — Board of Registry and Members of Advisory Committee — Parlor J. 6:30 P.M. Dinner — Executive Session — Board of Governors and Executive Council — Parlor J.

MONDAY, September 20

8 A.M. Registration.
9 A.M. ENAMINATION OF TECHNICIANS by American Registry of Physical Therapy Technicians — Parlors A, B, C, D.
10 A.M. Luncheon and Inspection of Exhibits.

Registry B, C, D 12 to 2 P.M. 2 to 5 P.M. 5 to 6 P.M. 6 to 8 P.M. 5 P.M. FOI

J. D., M. Luncheon and Inspection of Exhibits, M. BUSINESS SESSION — Pavillon Caprice, M. Inspection of Exhibits, M. Dinner. FORMAL OPENING SESSION — Pavillon Caprice.

TUESDAY, September 21

8 A.M. Registration.
9 to 12 Noon. Seminars in Sections:
(a) SECTION ON MEDICINE — Parlors A, B, C, D.
(b) SECTION ON SURGERY — Parlors E, F.
(c) SECTION ON MISCELLANEOUS SUBJECTS —
Parlor G.
Parlor G.

(c) SECTION ON MISCELLASTOCK (d) Parlor G.
(d) SECTION ON EENT — Parlor H.
12 to 2 P.M. Luncheon and Inspection of Exhibits.
to 5 P.M. SECTION ON EENT — Parlor H.
10 5 P.M. GENERAL SCIENTIFIC SESSION — Pavillon

to 8 P.M. GENERAL SCIENTIFIC CLOSES
Caprice,
to 6 P.M. Inspection of Exhibits.
to 8 P.M. Dinner.
P.M. IOINT MEETING WITH ACADEMY OF MEDICINE OF CINCINNATI — Pavillon Caprice.

WEDNESDAY, September 22

8 A.M. Registration. 9 to 12 Noon. Semin

(a) (b)

oon. Seminars in Sections:
SECTION ON MEDICINE — Parlors A, B, C, D.
SECTION ON X-RAY THERAPY — Parlors E, F.
SECTION ON MISCELLANEOUS SUBJECTS — (c)

Pavillon Caprice.
(d) SECTION ON GASTROENTEROLOGY — Parlor

G.
(e) SECTION ON EENT — Parlor H.
12 to 2 P.M. Luncheon and Inspection of Exhibits.
2 to 5 P.M. SECTION ON EENT — Parlor H.
2 to 5 P.M. GENERAL SCIENTIFIC SESSION — Pavillon

Caprice.
5 to 6 P.M. Inspection of Exhibits.
6:30 P.M. ANNUAL CONGRESS DINNER — Pavillon 6:30 P.M

THURSDAY, September 23

8 A.M. Registration.
9 to 12 Noon. GENERAL SCIENTIFIC SESSION—
Pavillon Caprice.
12 to 2 P.M. Linncheon and Inspection of Exhibits.
2 to 5 P.M. GENERAL SCIENTIFIC SESSION—

Pavillon Caprice.
5 to 6 P.M. Inspection of Exhibits.
6 to 8 P.M. Dinner and Inspection of Exhibits.
8 P.M. EDUCATIONAL CONFERENCE—Pavillon Caprice

FRIDAY, September 24

8 A.M. Registration.
9 to 12 Noon. GENERAL SCIENTIFIC SESSION —
Pavillon Caprice.
12 to 2 P.M. Luncheon and Inspection of Exhibits.
2 to 5 P.M. GENERAL SCIENTIFIC SESSION —
Pavillon Caprice.

SATURDAY, September 25

INFORMAL VISIT TO CINCINNATI HOSPITALS

Press Headquarters, Parlor O

FORMAL OPENING SESSION

MONDAY, September 20, 8 P. M.

Pavillon Caprice

WILLIAM BIERMAN, M.D., New York, Presiding

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ADDRESSES OF WELCOME

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INDUCTION OF THE PRESIDENT-ELECT ADDRESS:

The Future Development of Physical Therapy

Frederick L. Wahrer, M.D., Marshalltown, Iowa

ADDRESS:

Deformities Following Fractures: Treatment Their Prevention and

Melvin S. Henderson, M.D.

Professor of Orthopaedic Surgery

Mayo Foundation, University of Minnesota Rochester, Minnesota

ADDRESS

The Physiologist Looks at Physical Therapy

Anton J. Carlson, Ph.D., M.D.

Professor and Chairman of Department of Physiology, University of Chicago Chicago, Illinois

SECTION ON MEDICINE

TUESDAY, September 21, 9 A. M.

Parlors A, B, C, D

OFFICERS OF THE SECTION
Chairman — Kristian G. Hansson, M.D., New York.
Secretary — B. S. Troedsson, M.D., Bryn Mawr, Pa.

101. Present Status of Massage.

HANS J. BEHREND, M.D., Adjunct Physical Therapist, Hospital for Joint Diseases. NEW YORK.

Discussion: John D. Currence, M.D., New York; Alfred B. Olsen, M.D., Battle Creek, Michigan.

102. Considerations of the Pathogenesis of the Cerebral Defect in Spastic Children.

Defect in Spastic Children.

ALBERT T. STEEGMANN, M.D., Senior Instructor in Neurology and Clinical Pathology, Western Reserve University School of Medicine.

CLEVELAND.

103. The Spastic Child.

FRANK H. EWERHARDT, M.D., Professor of Physical Education; Assistant Professor of Physical Therapy, Washington University School of Medicine. ST. LOUIS.

Discussion of foregoing papers: Frank H. Krusen, M.D., Rochester, Minn.; William W. Worster, M.D., San Gabriel, California; Jessie Wright, M.D., Pittsburgh, Penn.

104. The Therapeutic Value of Postural Correction. (Illustrated.)

JESSE T. NICHOLSON, M.D., Associate in Orthopaedics, University of Pennsylvania Graduate School of Medicine,

and LOUIS B. LAPLACE, M.D., Instructor in Medicine, University of Pennsylvania School of Medicine; Associate in Cardiology, University of Pennsylvania Graduate School of Medicine.

PHILADELPHIA.

105. Postural Education.

JOSEPH E. MALCOMSON, M.D., L. Commander (M.C.) United States Navy, Ret. Lieutenant

DETROIT. Discussion of foregoing papers: John S. Coulter Chicago; James C. Elsom, M.D., Madison, Wisconsin. Coulter, M.D.,

SECTION ON SURGERY

TUESDAY, September 21, 9 A. M.

Parlors E, F

OFFICERS OF THE SECTION Chairman — Hu C. Myers, M.D., Phillipi, W. Secretary — Owsley Grant, M.D., Louisville.

111. Value of Sitz Baths in the Treatment of Genito-Urinary Diseases.

CHARLES FERGUSON, M.D. United States Public Health Service M.D., Representative,

STAPLETON, N. Y.

Discussion: E. O. Swartz, M.D., Cincinnati; Euclid Smith, M.D., Hot Springs, Arkansas.

112. Transvesical Electrosurgery of Prostate and Vesical Neck. (Illustrated.)

CARL J. UTHOFF, M.D., Clinical Associate, Genito-Urinary Surgery, Loyola University School of Medicine. CHICAGO.

113. Transurethral Prostatic Resection.

CHARLES J. McDEVITT, M.D., President, Academy of Medicine of Cincinnati. CINCINNATI

Discussion of foregoing papers: Elmer Hess, M.D., Erie Pennsylvania; Parke G. Smith, M.D., Cincinnati.

Maternal Morbidity and Mortality — How Physical Therapy Can Help to Reduce it.

M. C. L. McGUINNESS, M.D., Director of Physi-l Therapy, Lenox Hill, and Misericordia Hospitals. NEW YORK.

Discussion: L. A. Tarbell, M.D., New Haven, Connecticut; J. G. Jenkins, M.D., Temple, Texas.

Utero-Salpingograms and Trans-Uterine Insufflation as a Means of Pre-Determining Physical Ther-apy Procedure. (Illustrated.)

GEORGE LYFORD, M.D., Clinician in Gynecological Division of O. P. D., Cincinnati General Hospital; Staff, C. R. Holmes Memorial Hospital.

CINCINNATI

Discussion: Charles O. McCormick, M.D., Indianapolis; Frank M. Coppock, M.D., Cincinnati.

SECTION ON MISCELLANEOUS SUBJECTS

TUESDAY, September 21, 9 A. M.

Parlor G

OFFICERS OF THE SECTION - A. D. WILLMOTH, M.D., Louisville, - CORA SMITH KING, M.D., Hollywood, Cal.

121. Cervicitis Vaginitis Syndrome.

MELVIN A. ROBLEE, M.D., Instructor in Obstetrics and Gynecology, Washington University School of Medicine. ST. LOUIS.

122. Electrosurgery of the Cervix After Six Years.

MOSER LYON STADIEM, M.D., Assistant Pro-essor of Gynecology, Louisiana State University fessor of Gyn Medical Center. NEW ORLEANS.

Discussion of foregoing papers: William E. Ground, M.D., Superior, Wisconsin; A. D. Willmoth, M.D., Louisville; J. W. Hoffman, M.D., Indianapolis; Harry E. Kimble, M.D., Chicago; Don B. Bowers, M.D., Indianapolis.

123. Studies on the Value of Intravaginal Phototherapy.

ALFONS LANDEKER, M.D., Former Assistant, Charité Polyclinic Hospital, Berlin, Germany.

NEW YORK.

Discussion: Heinrich F. Wolf, M.D., New York; Milton Abramson, M.D., Minneapolis.

124. Diathermy in Coronary Thrombosis.

W. W. BLACKMAN, M.D., Medical Superintendent, Blackman Sanitorium, and

JEFF L. RICHARDSON, M.D., Instructor in Medicine, Emory University School of Medicine.

ATLANTA

Discussion: M. J. Barry, M.D., Indianapolis; Albert A Martucci, M.D., Philadelphia.

125. What Are the Indications for the Surgical Treat-

VIRGINIA SHEPHERD TANNENBAUM, M.D. Clinical Assistant in Medicine; Consultant in Physical Therapy, Buffalo General Hospital.

Discussion: Gustavas M. Blech, M.D., Chicago; Jacob Gutman, M.D., Brooklyn.

SECTION ON OPHTHALMOLOGY AND OTOLARYNGOLOGY

TUESDAY, September 21, 9 A. M.

Parlor H

OFFICERS OF THE SECTION

Chairman — FREDERICK L. WAHRER, M.D., Marshalltown, Ia. Secretary — Charles R. Brooke, M.D., Newark, New Jersey.

Changes in the Nasal Membranes and Discharge by the Elliott Treatment.
 Changes in the White Blood Count by the El-liott Treatment.

FRANK L. BRYANT, M.D., Instructor in Oto-laryngology, University of Minnesota Medical School. MINNEAPOLIS.

132. The Elliott Treatment in Ophthalmology.
MAXWELL SPENCER UDELF, M.D., Assistant Clinician, Mount Sinai Hospital.

Discussion of foregoing papers: Lewis J. Silvers, M.D., ew York; Farel Jouard, M.D., New York; M. B. Coffman, D., Richmond, Va.; C. E. Schrimpf, M.D., Cincinnati.

Fever Therapy in Ocular Diseases.
 JACOB M. BERRIS, M.D., Associate Attending Physician, Grace Hospital.

MAX K. NEWMAN, M.D., Lecturer, Fever Therapy, Grace Hospital.

134. Hyperpyrexia in the Treatment of Ocular Manifestations of Syphilis.

ALBERT N. LEMOINE, M.D., Chief, Eye Service, Kansas City Municipal Hospital, and Alfred Benjamin Dispensary.

KANSAS CITY, MO.

Discussion of foregoing papers: John S. McGavic, M.D., Cincinnati; M. S. Harding, M.D., Indianapolis.

SECTION ON OPHTHALMOLOGY AND OTOLARYNGOLOGY

TUESDAY, September 21, 2 P. M.

Parlor H

OFFICERS OF THE SECTION

Chairman — HARRIS H. VAIL, M.D., Cincinnati. Secretary — FRANK FOLLWEILER, M.D., Philadelphia.

135. Clinical Examination of the Labyrinthine Reflex by the Galvanic Falling Reaction.
EDWIN J. BLONDER, M.D., Otologist to the Department of Nervous and Mental Diseases, Northwestern University Medical School.

Discussion: Noah Fabricant, M.D., Chicago; Carl B. Sporth, M.D., Indianapolis.

136. Roentgen Therapy in Acute Mastoiditis. RAPHAEL SCHILLINGER, M.D., Ass Chief in Otolaryngology, Lutheran Hospital. Associate-in-

BROOKLYN. Discussion: Ralph S. Chappell, Harold G. Reineke, M.D., Cincinnati. M.D., Indianapolis;

117. Radium Therapy in Benign Conditions of the Ear, Nose and Throat.
J. COLEMAN SCAL, M.D., Associate Attending Physician in Otolaryngology; Chief of Clinic, Ear, Nose and Throat, Beth Israel Hospital.

NEW YORK.

138. Postoperative Use of Radium for Nasal Polyps.

WALTER A. FORD, M.D., Otolaryngologist to the Sheboygan Clinic.

Discussion of foregoing papers: H. L. Brooks, M.D., Michigan City, Indiana; William H. Kennedy, M.D., Indianapolis.

139. Climatic and Non-Operative Treatment of Sinusitis. GEORGE M. RANDALL, Major, M.C., U. S. Army, Ret., Consultant, Halifax District Hospital.

DAYTONA BEACH, FLA.

Discussion: Charles R. Brooke, M.D., Newark, N. J., M. H. Cottle, M.D., Chicago; Louis A. Witzeman, M.D., Akron, Ohio.

GENERAL SCIENTIFIC SESSION

TUESDAY, September 21, 2 P. M.

Pavillon Caprice

OFFICERS OF THE SECTION Chairman — RICHARD KOVÁCS, M.D., New York Secretary — Upton Giles, M.D., New Orleans.

SYMPOSIUM ON HYPERPYREXIA

A Comparison of Physical Methods in Fever Production from a Physiological Viewpoint. (Illustrated.)

KENNETH PHILLIPS, M.D., Chief of Department of Fever Therapy, Victoria Hospital; Chief of Medi-cal Service, James M. Jackson Memorial Hospital.

MIAMI, FLA.

143. Effect of Artificial Hyperpyrexia on Gonococcic Infections.

WILLIAM J. EGAN, M.D., Assistant Clinical Pro-essor of Medicine, Marquette University School of fessor of Medicine,

ROBERT G. PIASKOSKI, M.D., Resident Physician, Department of Physical Therapy, Milwaukee County Hospital.

MILWAUKEE.

144. Hyperpyrexia in the Treatment of Lymphopathia Venerea.

ELMORE B. TAUBER, M.D., Professor of Dermatology and Syphilology, University of Cincinnati College of Medicine,

JOHN B. SQUIRES, M.D., Resident in Dermatology, Cincinnati General Hospital.

CINCINNATI.

145. Fever Therapy Survey at the Cleveland Clinic.

WALTER J. ZEITER, M.D., Director of Department of Physical Therapy, Cleveland Clinic.

CLEVELAND.

146. Fever Therapy at High Humidities.
WILLIAM FINKELSTEIN, M.D., Directe
Physical Therapy, Manhattan General Hospital. Director of

Discussion: Norman E. Titus, M.D., New York; Frank H. Krusen, M.D., Rochester, Minnesota; Fred Goldman, M.D., Cincinnati; William Bierman, M.D., New York; William H. Schmidt, M.D., Philadelphia.

JOINT SPECIAL MEETING

AMERICAN CONGRESS OF PHYSICAL THERAPY

ACADEMY OF MEDICINE OF CINCINNATI TUESDAY, September 21, 8 P. M.

Pavillon Caprice

- CHARLES J. McDevitt, M.D., President,
 Academy of Medicine of Cincinnati
 FREDERICK L. WAHRER, M.D., President,
 American Congress of Physical Therapy
- Physical Therapy What Is It and What Will It Do? HARRY E. MOCK, M.D., Associate Professor of Surgery, Northwestern University Medical School; Chairman, Council on Physical Therapy, American Medical Association; Senior Surgeon, St. Luke's Hospital.
- The Conception of Reaction in Physical Treatment.

 J. VAN BREEMEN, M.D., Honorary Secretary and Director of the International Advisory Bureau of the Ligue Internationale contre le Rhumatisme; Medical Director of the Consulting Bureau for Rheumatic Diseases of the Dutch Society on Rheumatism.
- AMSTERDAM, HOLLAND. Ultrashort Wave (Diathermy) Low Intensity Treatment.
 EUGEN WEISSENBERG, M.D., Medical Superintendent, Short Wave Section, University Clinic for Mental and Nervous Diseases.
 VIENNA, AUSTRIA.

SECTION ON MEDICINE WEDNESDAY, September 22, 9 A. M. Parlors A, B, C, D

OFFICERS OF THE SECTION Chairman — N. H. POLMER, M.D., New Orleans. Secretary — A. J. KOTKIS, M.D., St. Louis.

- 201. Short Wave Diathermy in the Treatment of Pneumonia.
 - JOHN S. HIBBEN, M.D., Director of Physical Therapy, St. Luke's Hospital, Pasadena; Chief of Consulting Staff in Physical Therapy, Huntington Memorial Hospital, Los Angeles. PASADENA, CAL.

202. One Hundred and Two Cases of Pneumonia Treated by Diathermy. (Illustrated.)

JAMES O. FITZGERALD, JR., M.D., Assistant, Medical Staff, Stuart Circle Hospital.

RICHMOND, VA.

Discussion of foregoing papers: Harry Eaton Stewart, M.D., New Haven, Connecticut; Norman E. Titus, M.D., New York; J. G. Jenkins, M.D., Temple, Texas.

203. Physical Therapy — Values and Methods of Extending Its Use in Internal Medicine.

PETER IRVING, M.D., Secretary, Medical Society of the State of New York; Consulting Physician, New York City, and Seton Hospitals.

NEW YORK.

Discussion: Nelson Morris, M.D., Toledo, Ohio; Disraeli Kobak, M.D., Chicago.

- 204. Exercise in the Treatment of Chronic Cardiac Vas
 - cular Disease.
 LOUIS FAUGERES BISHOP, JR., M.D., Instructor in Graduate Courses in Internal Medicine, Columbia University Extension School of Medicine.

- Discussion: C. J. Clark, M.D., Indianapolis; James C. Elsom, M.D., Madison, Wisconsin; M. C. L. McGuinness, M.D., New York.
- 205. The Clinical Aspects of the Reaction of Degenera
 - tion.
 J. FREEMONT BATEMAN, M.D., Professor of Clinical Psychiatry, Ohio State University School of Medicine; Superintendent, Columbus State Hospital, COLUMBUS, OHIO. and
 - B. BILLMAN, M.D., Director of Physical Therapy, Union Bethel Clinic and Longview Hospital.

CINCINNATI.

Discussion: Hans J. Behrend, M.D., New York; Joseph Malcomson, M.D., Detroit; Samuel Warshaw, M.D., Brooklyn.

SECTION ON X-RAY THERAPY

in cooperation with

Radiological Section - Academy of Medicine of Cincinnati

WEDNESDAY, September 22, 9 A. M.

Parlors E. F.

OFFICERS OF THE SECTION Chairman — HAROLD G. REINEKE, M.D., Cincinnati. Secretary — R. W. Fouts, M.D., Omaha.

SYMPOSIUM ON X-RAY THERAPY

- The Treatment of Acute and Chronic Infections with the X-Ray.
 SIDNEY LANGE, M.D., Professor of Radiology, University of Cincinnati College of Medicine.
 CINCINNATI.
- 212. X-Ray Therapy for Infections.

 EUGENE T. LEDDY, M.D., Assistant Professor of Radiology, Mayo Foundation, University of Min-
- ROCHESTER, MINN. 213. X-Ray Treatment of Gas Gangrene.

 JAMES F. KELLY, M.D., Professor of Radiology and Physical Therapy, Creighton University School of Madienters.
- 214. The Scope of X-Ray Therapy in Dermatology.

 ERWIN P. ZEISLER, M.D., Assistant Professor of Dermatology, Northwestern University Medical School; Attending Dermatologist, Michael Reese Hospital.
- CHICAGO. Discussion: Ellis R. Bader, M.D., Cincinnati; H. F. Plaut, M.D., Cincinnati; Gustav Bucky, M.D., New York; Samuel Brown, M.D., Cincinnati.

SECTION ON MISCELLANEOUS SUBJECTS WEDNESDAY, September 22, 9 A. M.

Pavillon Caprice

OFFICERS OF THE SECTION Chairman — Edwin L. Libbert, M.D., Lawrenceburg, Ind. Secretary — Euclid Smith, M.D., Hot Springs, Ark.

221. Posture Grading as Applied to Treatment of Chronic Arthritis.

EDWARD F. HARTUNG, M.D., Assistant Professor of Clinical Medicine, New York Post-Graduate Hospital, Columbia University. NEW YORK

PHILADELPHIA.

222. Calcium Deposits Around the Subacromial Bursa and the Supraspinatus Tendon Treated with

Diathermy,
B. S. TROEDSSON, M.D., Director of Physical
Therapy, Bryn Mawr Hospital.
BRYN MAWR, PA.

223. The Use of Fango in Treating Arthritis.

EMIL J. VRTIAK, M.D., Associate Clinical Professor of Medicine, Rush Medical College of the University of Chicago;

SIMON BENSON, Ph.D., Instructor and Research Associate, Department of Physiology, University of Chicago.

Chicago; DISRAELI KOBAK, M.D., Assistant Clinical Pro-fessor of Medicine (Physical Therapy), Rush Medical College of the University of Chicago,

ANTON J. CARLSON, Ph.D., M.D., Professor and Chairman of Department of Physiology, University of

Discussion of foregoing papers: Frank H. Walke, M.D., Shreveport, Louisiana; John D. Currence, M.D., New York; Euclid Smith, M.D., Hot Springs, Arkansas; Norman E. Titus, M.D., New York.

224. Fever Therapy in Gonorrheal Arthritis.

ROBERT M. STECHER, M.D., Senior Clinical Instructor in Medicine, Western Reserve University School of Medicine.

and

WALTER M. SOLOMON, M.D., Staff, Cleveland City Hospital.

CLEVELAND. 225. Ultrashort Wave in Hyperpyrexia. (Illustrated.)
SAMUEL GOTTESMAN, M.D., Acting Director
and Associate of Physical Therapy, Beth Israel Hos-

NEW YORK.

Discussion of foregoing papers: Ben L. Boynton, M.D., Madison, Wisconsin; Sidney Licht, M.D., New York; Upton Giles, M.D., New Orleans.

SECTION ON GASTROENTEROLOGY WEDNESDAY, September 22, 9 A. M.

Parlor G

OFFICERS OF THE SECTION
Chairman — B. BILLMAN, M.D., Cincinnati.
Secretary — JAMES W. WILTSIE, M.D., Binghamton, N. Y.

231. The Role of Bacterial Hypersensitivity in the Irritable Colon Syndrome. STANLEY E. DORST, M.D., Associate Professor of Medicine, University of Cincinnati College of Medicine.

CINCINNATI. Discussion: William G. French, M.D., Evdiana; Ephraim Goldfain, M.D., Oklahoma City. Evansville, In-

of Failure of Permanent Results from Colonic Therapy.

JAMES W. WILTSIE, M.D., Consultant in Physical Therapy, Binghamton City Hospital.

BINGHAMTON, N. Y.

Discussion: C. F. Voyles, M.D., Indianapolis; R. W. Heald, M.D., Battle Creek, Michigan.

233. Rational Colon Therapy. WILLIAM W. WORSTER, M.D., President, California Collège of Medical Technicians. SAN GABRIEL, CAL.

Discussion: J. W. Torbett, M.D., Marlin, Texas; L. H. Block, M.D., Chicago.

234. Treatment of Protozoa in the Alimentary Tract, CORA SMITH KING, M.D., Director of Physical Therapy, Hollywood Hospital; JOHN V. BARROW, M.D.,

FREDERICK F. STRONG, M.D.

HOLLYWOOD, CAL.

235. The Treatment of Paracytic Infestation of the Colon by Means of Colonic Irrigation and Hot Instillations.

Instillations.

DAMASO de RIVAS, M.D., Professor of Parasitology, University of Pennsylvania Graduate School of Medicine; Assistant Professor, Department of Pathology, University of Pennsylvania School of Medicine.

Discussion of foregoing papers: John S. Hibben, M.D., Pasadena, California; Anna Hagemann, M.D., Cincinnati.

SECTION ON OPHTHALMOLOGY AND OTOLARYNGOLOGY

WEDNESDAY, September 22, 9 A. M. Parlor H

OFFICERS OF THE SECTION Chairman — Lewis J. Silvers, M.D., New York. Secretary — Carl B. Sputh, M.D., Indianapolis.

SYMPOSIUM ON IONIZATION

241. Use of Ionization in the Treatment of Hay Fever and Allergic Rhinitis.

EDWARD KING, M.D., Assistant Professor of Laryngology, University of Cincinnati College of Medicine. CINCINNATI.

242. Further Studies on the Histopathologic Effects of

A. R. HOLLENDER, M.D., Associate in Laryngology, Rhinology and Otology, University of Illinois College of Medicine,

NOAH FABRICANT, M.D., Instructor in Laryngology, Rhinology and Otology, University of Illinois College of Medicine. CHICAGO.

243. Studies with Ionization on Animal Eyes. GUSTAV ERLANGER, M.D. NEW YORK.

244. Status of Ionization in Nasal Allergy.

FRENCH K. HANSEL, M.D., Assistant Professor of Otolaryngology, Washington University School of Medicine.

Discussion: A. J. Cone, M.D., St. Louis; Frank Foll-weiler, M.D., Philadelphia; Henry L. Sinskey, M.D., Baltimore; Carl B. Sputh, M.D., Indianapolis; Virgil L. Payne, M.D., Pine Bluff, Arkansas.

SECTION ON OPHTHALMOLOGY AND OTOLARYNGOLOGY

WEDNESDAY, September 22, 2 P. M.

Parlor H

OFFICERS OF THE SECTION

Chairman — A. J. Cone, M.D., St. Louis. Secretary — Cleon W. Symonds, M.D., Los Angeles.

245. X-Ray Treatment of Nasal Accessory Sinus Disease. H. F. PLAUT, M.D.

Discussion: Raphael Schillinger, M.D., Brooklyn, New York; Eugene T. Leddy, M.D., Rochester, Minnesota.

246. The Treatment of Lesions of the Mouth and Face by Electrosurgery.

J. THAYER WALDO, D.D.S., M.D., Staff, Department of Oral Surgery, Methodist, and City Hospitals.
INDIANAPOLIS.

247. Status of Electrosurgery in Cancer of the Nasal Sinuses.

EDWIN N. KIME, M.D., Assistant Professor of Surgery, Indiana University School of Medicine.

INDIANAPOLIS.

Discussion of foregoing papers: George A. Wyeth, M.D., New York; Gustavus M. Blech, M.D., Chicago; Lewis J. Silvers, M.D., New York; W. H. Schmidt, M.D., Phila-delphia.

248. Further Observations on the Electrosurgical Management of Retinal Separation.

OSCAR B. NUGENT, M.D., Professor of Ophthalmology, Chicago Eye, Ear, Nose and Throat College.

Discussion: M. H. Cottle, M.D., Chicago; K. L. Stoll, M.D., Cincinnati; H. E. Martin, M.D., La Fayette, Kentucky. 249. Fulguration of Contact Ulcers of the Vocal Cords. ROBERT E. HOWARD, M.D., Instructor in Oto-aryngology, University of Cincinnati College of

CINCINNATI.

Discussion: Frederick L. Wahrer, M.D., Marshalltown, Iowa; Charles S. Amidon, M.D., Cino unati.

GENERAL SCIENTIFIC SESSION WEDNESDAY, September 22, 2 P. M.

Pavillon Caprice

OFFICERS OF THE SECTION Chairman — John S. Hibben, M.D., Pasadena, Cal. Secretary — M. C. L. McGuinness, M.D., New York.

251. Experiments in Sterility of Male Animals Induced by Radiant Heat. UPTON GILES, M.D., Professor of Physical Therapy, Louisiana State University Graduate School Therapy, Los of Medicine,

A. L. HARVEY, B.P.E., A.B.

NEW ORLEANS. Discussion: William J. Egan, M.D., Milwaukee; William Bierman, M.D., New York.

252. Clinical Observations on the Uses of Irradiated

BURTON E. HYDE, M.D., Staff, Stouder Hos-

TROY, OHIO. Discussion: Disraeli Kobak, M.D., Chicago; Allan Hemingway, Ph.D., New Haven, Connecticut.

253. Evaluation of the Accepted Methods of Treating So-Called Wassermann-Fast Syphilis.

JAMES KIRBY HOWLES, M.D., Assistant Professor of Dermatology and Syphilology, Louisiana State University Medical Center.

NEW ORLEANS.

Discussion: Elmer Hess, M.D., Erie, Pennsylvania; Wal-r J. Zeiter, M.D., Cleveland; Julian Benjamin, M.D., Cin-

254. Effect of Ultraviolet and Visible Rays on Carbohy-drate Metabolism.

LUDWIG PINCUSSEN, Ph.D., M.D., Research Associate, Department of Physiology, University of Illinois College of Medicine.

255. Ultraviolet in Secondary Anemia.
RICHARD KOVACS, M.D., Clinical Professor of Physical Therapy, New York Polyclinic Medical School and Hospital; Physician in Charge of Physical Therapy, City Hospital. NEW YORK.

Discussion of foregoing papers: Albert P. Mathews, Ph.D., Cincinnati; Miland E. Knapp, M.D., Minneapolis; N. H. Polmer, M.D., New Orleans.

GENERAL SCIENTIFIC SESSION THURSDAY, September 23, 9 A. M.

Pavillon Caprice

OFFICERS OF THE SECTION Chairman — NORMAN E. TITUS, M.D., New York. Secretary — Albert A. Martucci, M.D., Philadelphia.

301. Rehabilitation of the Disabled. (Illustrated.) HENRY H. KESSLER, M.D., Ph.D., Medical Di-rector, New Jersey Rehabilitation Clinic; Attending Orthopedic Surgeon, Newark City Hospital, Newark Beth Israel Hospital.

NEWARK N. I. Discussion: J. H. Hennemuth, M.D., Emaus, Pennsylvania; Cassius Lopez de Victoria, M.D., New York.

302. Psychological Aspects of Physical Therapy. WILLIAM C. MENNINGER, M.D., Medical Director, Menninger Psychiatric Hospital and Sanitarium, and BYRON L. SHIFFLET, M.D., Assistant Instructor, Abnormal Psychology, Washburn College.

TOPEKA.

Discussion: Ralf Hanks, M.D., Fulton, Missouri; Alfred B. Olsen, M.D., Battle Creek, Mich.; E. P. Cayo, M.D., San Antonio, Texas.

Electrotherapy and Chemotherapy Including Sulfan-ilamide in Gonorrhea and Its Complications.
 FRANCIS H. REDEWILL, M.D., Assistant in Urology, University of California Medical School.

SAN FRANCISCO.

Discussion: Hu C. Myers, M.D., Phillipi, W. Va.; Carl J. Uthoff, M.D., Chicago.

304. The Electrolytic Action Between Metals as Used in Bone Surgery. (Illustrated.) CHARLES S. VENABLE, M.D., Attending Sur-geon, Nix Hospital; Visiting Surgeon, Medical and

Surgical Hospital. SAN ANTONIO.

Chicago; G. II. Discussion: Philip Lewin, M.D., Ch McKinstry, M.D., Washington, Pennsylvania

305. Physical Therapy — Its Value and Practical Application in Rural Practice.

HAROLD J. HARRIS, M.D., Associate Physician, Champlain Valley Hospital; Consulting Physician, St. Laurence State Hospital. WESTPORT, N. Y.

Discussion: E. W. Rothermel, M.D., Reading, Pennsylvania; G. A. Zerzan, M.D., Holyrood, Kansas; W. E. Ground, M.D., Superior, Wisconsin.

GENERAL SCIENTIFIC SESSION THURSDAY, September 23, 2 P. M.

Pavillon Caprice

OFFICERS OF THE SECTION Chairman — Melvin S. Henderson, M.D., Rochester, Minn. Secretary — Val Parmley, M.D., Little Rock, Ark.

SYMPOSIUM ON FRACTURES

306. Value of the Roentgenogram in the Diagnosis of Fractures. ROY W. FOUTS, M.D., President, Nebraska State . Medical Association.

OMAHA.

307. Ununited Fractures of the Long Bones. (Illustrated.)

WILLIS C. CAMPBELL, M.D., Professor of Orthopaedic Surgery, University of Tennessee College of Medicine. MEMPHIS

308. The Role of Physical Therapy in Fractures of the Lower Extremities. (Illustrated.)

PHILIP LEWIN, M.D., Associate Professor of Orthopaedics, Northwestern University Medical School.

CHICAGO.

309. Immediate and Early Physical Therapy in Fracture Treatment. CLAY RAY MURRAY, M.D., Associate Professor of Surgery, Columbia University College of Physi-

of Surgery, Columb NEW YORK.

310. Some Factors in Fracture End-Results.

LEEMAN E. SNODGRASS, M.D., Instructor in Surgery, University of Pennsylvania School of Medi-

PHILADELPHIA.

Discussion: Walter G. Stern, M.D., Cleveland; John W. leCammon, M.D., Cincinnati; Val Parmley, M.D., Little

EDUCATIONAL CONFERENCE

THURSDAY, September 23, 8 P. M.

Pavillon Caprice

OFFICERS OF THE SECTION - WILLIAM BIERMAN, M.D., New York. - MARION G. SMITH, B.S., Chicago. Chairman -

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311. Function of the County Medical Society in Physical Therapy Education of the General Practitioner. WILLIAM H. SCHMIDT, M.D., Assistant Pro-essor of Physical Therapy, Jefferson Medical College.

PHILADELPHIA. 312. Function of the Council on Medical Education and Hospitals In the Standardization of Schools for Physical Therapy Technicians.

O. N. ANDERSEN, M.D., Staff, Council on Medi-l Education and Hospitals, American Medical As-CHICAGO.

313. Ten Years of Hospital Physical Therapy. JOSEPH A. SYRACUSE, M.D., Chief, Pl Therapy Department, Buffalo Columbus Hospital Physical

BUFFALO.

GENERAL SCIENTIFIC SESSION FRIDAY, September 24, 9 A. M.

Pavillon Caprice

OFFICERS OF THE SECTION
Chairman — William H. Schmidt, M.D., Philadelphia.
Secretary — Frank H. Krusen, M.D., Rochester, Minn.

SYMPOSIUM ON VASCULAR DISEASES

101. Role of Vascular Instability in Development of Endocarditis.

ALEXANDER J. NEDZEL, M.D., Associate Pro-fessor in Pathology and Bacteriology, University of Illinois College of Medicine. CHICAGO.

102. Tissue Circulation and Arterio-venous Shunt in Peripheral Vascular Disease.

KARL HARPUDER, M.D., Assistant Clinical Pro-fessor of Medicine, Columbia University College of Physicians and Surgeons. NEW YORK.

403. The Limitations of Alternate Suction and Pressure Therapy in the Management of Obliterative Vas-cular Diseases of the Extremities. J. ROSS VEAL, M.D., Assistant Professor of Sur-gery, Louisiana State University Medical Center.

NEW ORLEANS

404. The Importance of Physical Measures in the Management of Peripheral Vascular Diseases.

LOUIS G. HERRMANN, M.D., Assistant Professor of Surgery, University of Cincinnati College of Medi-cine and Cincinnati General Hospital. CINCINNATI.

405. The Use of Intermittent Venous Occlusion in the Treatment of Peripheral Vascular Disease.

WILLIAM S. COLLENS, M.D., Metabolist and Adjunct Physician, Israel Zion Hospital, and

DAVID N. WILENSKY, M.D., Clinical Assistant, Department of Metabolism, Israel Zion, and Kings County Hospitals. BROOKLVN.

Discussion: Charles S. Lakeman, M.D., Rochester, New York; Jerome Weiss, M.D., Brooklyn; R. V. August, M.D., Muskegon, Michigan; William H. Magill, M.D., Providence, Rhode Island; Paul Merrell, M.D., Indianapolis.

GENERAL SCIENTIFIC SESSION

FRIDAY, September 24, 2 P. M.

Pavillon Caprice

OFFICERS OF THE SECTION Chairman — William J. Egan, M.D., Milwaukee. Secretary — Jerome Weiss, M.D., Brooklyn.

SYMPOSIUM ON SHORT WAVE

406. Physical and Biophysical Aspects of Short Wave Diathermy.
ALLAN HEMINGWAY, Ph.D., Assistant Professor, Department of Physiology, University of Minnesota; Sterling Fellow, Yale University.

NEW HAVEN, CONN.

407. Deep Heat Therapy with Ultra Short Hertzian Waves.

JOHANNES PAETZOLD, Ph.D., Physicist in Charge of Short Wave Laboratories at Erlangen.

ERLANGEN, GERMANY.

408. Temperature Determinations in Living Human Tissues and Phantoms by Short Wave Fields.

DISRAELI KOBAK, M.D., Assistant Clinical Professor of Medicine (Physical Therapy), Rush Medical College of the University of Chicago; ANTON J. CARLSON, Ph.D., M.D., Professor and Chairman of Department of Physiology, University of Chicago,

SIMON BENSON, Ph.D., Instructor and Research Associate, Department of Physiology, University of Chicago.

CHICAGO.

409. Diathermy vs. Short Wave. NORMAN E. TITUS, M.D.

NEW YORK.

Discussion: Howard A. Carter, B.S. in E.E., Chicago; John S. Coulter, M.D., Chicago; Heinrich Wolf, M.D., New York.

SCIENTIFIC EXHIBITS

Space No. 401 and 402

AMERICAN MEDICAL ASSOCIATION, COUNCIL ON PHYSICAL THERAPY.

Short demonstrational lectures of fifteen to twenty minutes each on physics as related to practice of Physical Therapy. Apparatus, charts and other equipment will be used in the demonstrations; charts bearing on the Council's educational program.

Space No. 403

DR. SAMUEL BROWN, DR. ARCHIE FINE,

Roentgenograms and photographs illustrating cancer cases before and after radiation treatment.

Space No. 404

DR. C. H. DRENCKHAHN, Urbana, Illinois.

The role of perirenal injections of gas in the radiological study of the adrenal glands.

Space No. 405

DR. GUSTAV BUCKY, New York.

Universal Electrical Amplifier and Dosimeter; Grenz ray results and films.

Space No. 406

DR. SAMUEL GOTTESMAN, Department of Physical Therapy, Beth Israel Hospital, New York.

Ultra short wave in combination with hot box in hyperpyrexia with charts and results.

Space No. 407, 408 and 409

DR. LOUIS G. HERRMANN, Department of Surgery, University of Cincinnati College of Medicine, Cincinnati.

Medicine, Cincinnati.

The Diagnosis and Treatment of Peripheral Vascular Diseases: Charts, photographs and drawings to show the means by which arterial insufficiency in extremities can be determined in the living subject and how insufficiency due to arterial spasm can be differentiated from that due to organic disease of the arteries. The management of arterial insufficiency of the extremities will be given in detail. Emphasis will be placed upon physical methods of increasing the peripheral arterial circulation and the passive vascular exercise method of stimulating the development of collateral arterial circulation in human extremities will be presented in detail. A practical demonstration of this method will also be presented.

Space No. 410

DR. A. R. HOLLENDER, DR. NOAH FABRICANT, Department of Laryngology, Rhinology, and Otology, University of Illinois College of Medicine, Chicago.

Physical therapy in diseases of the ear, nose and throat; apparatus, special electrodes, technical application. Histopathologic studies of nasal ionization and electrosurgery of the nose and pharynx.

Space No. 411 and 412

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL, Department of Physical Therapy, Chicago.

Electropyrexia — demonstrating the latest methods used at Northwestern University Medical School to elevate body temperature by physical agents. The resistance thermometer used for observing rectal temperature is demonstrated. Charts illustrating therapeutic results are shown for arthritis, general paresis, multiple sclerosis, asthma, chorea, primary and secondary apphilis.

Space No. 413, 414 and 415

DR. JAMES F. KELLY, Omaha.

The Treatment of Gas Gangrene with Roentgen Rays: Case reports and their analysis supported by temperature charts, x-ray films and other evidence, variations in types of cases and variations in technics and the results; graphs and charts showing final conclusions.

Space No. 416 and 417

DR. HENRY H. KESSLER, Newark, New Jersey.

Cineplastic Amputation: Photographs, plaster models, sample of prosthesis and motion pictures demonstrating the utility of the cineplastic prosthesis for those who have lost an arm in industrial and public accidents.

Space No. 418

DR. IRWIN G. SPIESMAN, DR. LLOYD ARNOLD, Chicago.

Susceptibility to Common Colds: Charts and graphs showing results of temperature studies of nasal mucosa under various environmental conditions; the influence of hydrotherapy, diet and mental hygiene in prevention of colds in various ways.

Space No. 419 and 420

DR. ROBERT M. STECHER, DR. BENJAMIN J. WOLPAW, Cleveland.

Artificial Fever Therapy of Ocular Diseases: Photographs demonstrating the appearance of the eye in various ocular diseases and showing the changes that occur following fever therapy; the diseases illustrated include interstitial keratitis, gonorrheal ophthalmia, rheumatic iritis and hypopyon; essential facts of the clinical history, details of the treatment administered, and description of the changes seen are included in labels for each picture.

Space No. 421 and 422

DR. WARREN C. BRIEDENBACH, Dayton, Ohio.

Approximately 150 chest films illustrating diagnostic and therapeutic procedures in both tuberculous and non-tuberculous lesions.

Space No. 423

DR. WALTER J. ZEITER, Cleveland.

Arthritis exhibit, consisting of wax models, x-rays and data on treatment.

Space No. 424 and 425

DR. RICHARD KOVACS, New York Polyclinic Medical School and Hospital, New York.

Instruction charts on electrotherapy, electrodiagnosis, light therapy and hydrotherapy. Charts showing experimental results with ultraviolet radiation in secondary anemia.

Space No. 426

DR. NORMAN E. TITUS, New York.

Small portable apparatus producing same current as static wave.

Space No. 427

DR. WILLIAM BENHAM SNOW and Staff, New York.

Exercise for postural correction, minor deformities and anomalies.

Space No. 428

COLUMBIA-PRESBYTERIAN MEDICAL CENTER, New York.

Fever therapy exhibit.

Space No. 429

AMERICAN PHYSIOTHERAPY ASSOCIATION AND VISITING NURSE ASSOCIATION OF CHICAGO

Improvised Home Apparatus. After care of poliomyelitis, Models of splints. Demonstration of making of splints. Pictures of home made apparatus.

Space No. 430

DR. F. W. WILLIAMS, DR. T. J. O'KANE, New York.

Injuries to diabetics caused by physical agents.

Space No. 431

DR. CHARLES I. SINGER, Long Beach, L. I., New York.

Thalassotherapy: Charts, graphs, statistics depicting biological effects and therapeutic utilization of seashore climate of the United States.

Space No. 432

DR. CHARLES S. VENABLE, San Antonio, Texas.

Electrolysis the Determining Factor in Osteosynthesis with Metals: Showing experiments in which different metals and alloys were used in various combinations, followed by macroscopic, microscopic, x-ray and biochemical examination; biochemical examination showing the transference of ions of one metal to the other, according to the laws of electromotive force of metals, showing that electrolysis is the controlling factor and that a metal entirely resistant to body fluids, acting as the electrolyte, must be used for consistent success in metallic-osteosynthesis.

Space No. 433

DR. K. HARPUDER, DR. I. D. STEIN, Montefiore Hospital, New York.

Photographs and arteriographs on the development of the collateral circulation and the effects of passive vascular exercise (animal experiments).

Space No. 434

DR. K. G. HANSSON, DR. K. COOLEY, New York.

Ultraviolet radiation in autotransfusion; wet compress with thermestatic control.

Space No. 435

DR. F. H. EWERHARDT, St. Louis.

An articulating posture manikin designed primarily for the purpose of teaching bodily mechanics.

Space No. 436

DR. B. S. TROEDSSON, Bryn Mawr, Pennsylvania

X-rays and charts of calcium deposits around the shoulder joint treated with diathermy.

Space No. 437 and 438

OR. A. J. NEDZEL, Chicago.

Experimental Endocarditis Due to Pressor Episode: Photocrographs, gross specimens and slides showing that iressin injections cause endothelial changes on the heart dives, which cause the stickiness of the endothelium and e settling of floating bacteria; in due time a bacterial docarditis develops; if no bacteria are present, the changes the heart valves (mostly mitral) resemble a rheumatic unbacterial) endocarditis.

Space No. 439

DR. HENRY A. RAFSKY, New York.

The Nonsurgical Treatment of Pyloric Obstruction Resulting from Peptic Ulcer: Showing observations on patients suffering from pyloric obstruction resulting from peptic ulcer and treated by nonsurgical measures for a period ranging from three to ten years; follow-up results of this study are reported; and nonsurgical measures, including the method to facilitate the passage of a duodenal tube through an occluded pylorus, are described; the clinical significance of inflamatory and cicatricial pyloric obstruction both from the medical and the surgical standpoint as well as the importance of gastric decompression as a preliminary procedure before operative intervention are illustrated; the danger of alkalosis in the treatment of patients is emphasized.

Space No. 440

DR. WALTER S. McCLELLAN, DR. O. BAUDISCH, Saratoga Springs, New York.

Series of charts describing the geological relations to the mineral waters, a map showing the distribution of the American Spas and graphs illustrating type and results of treatment.

Space No. 441

DR. GEORGE LYFORD, Cincinnati.

An apparatus to accurately, substantially and automatically procure essential data in the differential diagnosis of pelvic pathology in the female. It is used both for insufflation and in conjunction with standard x-ray equipment in making the utero-saloingograms.

Space No. 442, 443 and 444

DR. SAMUEL IGLAUER, DR. SAMUEL BROWN, Cincinnati.

Roentgenologic Studies of the Neck and Posterior Mediastinum: Exhibit of roentgenograms illustrating (1) normal anatomy of the neck in males and females at various ages; (2) the normal anatomic relationship of the superior and posterior mediastinum; (3) swellings due to infection of soft parts; i.e., retropharyngeal abscess, retro-esophageal mediastinitis, cellulitis, and so on; (4) tumors in the neck and mediastinum; (5) interstitial emphysema following perforation of the pharynx or esophagus; (6) methods of demonstrating the presence of opaque and nonopaque foreign bodies in the pharynx, larynx, trachea and esophagus; (7) the seating of appliances used in the treatment of laryngeal stenosis.

Space No. 445 and 446

DR. JOHN D. CURRENCE, New York.

Physical Therapy in Arthritis: Pictures and graphs demonstrating the application of physical therapy (electrotherapy and hydrotherapy) in arthritis and the reactions to be expected on the blood sedimentation rate, red blood cell count, white blood cell count, hemoglobin, differential blood count.

Space No. 447 and 448

DR. EDWARD F. HARTUNG, New York.

The Treatment of Chronic Arthritis: Pictures outlining the effective and generally recognized measures for treating chronic arthritis; constitutional therapy, diet, drug therapy, nonspecific protein therapy, hemolytic streptococcus vaccines and filtrates, orthopedic treatment, the correction of postural defects, and the relief of pain by nerve block.

Space No. 449

DR. FRANK H. KRUSEN, DR. EARL C. ELKINS. Rochester, Minnesota.

Fever Therapy in the treatment of gonorrhea.

Space No. 450, 451 and 452

DR. RAPHAEL SCHILLINGER, Brooklyn, New York.

Mastoids and Sinuses: Mastoids: Roentgenograms, bone specimens, charts and clinical notes demonstrating the value of roentgenological procedures in the diagnosis and treatment of mastoiditis. An anatomical classification of mastoids based on development is offered. Roentgen signs of mastoiditis are correlated to the histopathologic changes in the mastoid. The use of the roentgen ray as a therapeutic and prophylactic agent is discussed.

Private Dining Room K

AMERICAN OCCUPATIONAL THERAPY AS-SOCIATION, New York.

Occupational Therapy: Exhibit of charts, photographs, case histories and other objects presenting the principles of occupational therapy and the results of such treatment.

Georgian Room

DR. R. PLATO SCHWARTZ and ASSOCIATES, Gait Laboratory, Rochester University School of Medicine and Dentistry, Rochester, New York.

Pathology of Gastrocnemius and Soleus Muscles and Tendo-Achilles: A mechanical demonstration of the clinical value of electrobasographic records of human locomotion. The first case reveals the complete restoration of normal gait three years after operation for rupture of the tendo-Achilles. The second case reveals marked improvement and remaining limitations in locomotion three years after arthrodesis of the foot and transplantation of the peronei for paralysis of the gastrocnemius and soleus muscles. A mechanism which reproduces the motions of the pelvis, thigh, leg and foot in the stance and swing phases of a single step. This mechanism was constructed in the following manner: 16 mm. motion pictures were made at 64 exposures per sec-

thigh, leg and foot in the stance and swing phases of a single step. This mechanism was constructed in the following manner: 16 mm. motion pictures were made at 64 exposures per second, while a normal 22 year old male walked on a fifty foot platform. From this film, 77 consecutive frames were projected for plotting of the curves produced by the movement of the above members in a single step. These curves were reproduced in cams mounted on a shaft driven by an electric motor through a gear reducer. By means of levers riching on these cams, the movement of the pelvis, thigh, leg, and foot is reproduced as when one walks on a tread-mill. A demonstration in motion revealing the function of the extrinsic muscles of the foot. This is presented in three ways. First, a fresh dissection controlled by a mechanical device makes it possible to better understand the function of those muscles upon which the foot is dependent for normal progression. Second, a Kodachrome motion picture most clearly reveals the significance of this demonstration. Third, the function of these muscles, in terms of duration of contraction and relaxation, has been recorded with the electrobasograph simultaneous with the recording of gait. This provides for correlation of muscle function with respective phases of the step.

TECHNICAL EXHIBITS

Space No. 301, 302 and 303

BURDICK CORPORATION.

Complete line of physical therapy equipment. Features of especial interest will be the Burdick Corporation's new developments in the short wave and the ultraviolet fields.

Space No. 305

AMERICAN CYSTOSCOPE MAKERS, INC.

The Wappler Cold Cautery Scalpel will be demonstrated. This versatile little instrument will broaden your practice. Do not fail to investigate this! The Wappler Short Wave and Wappler Inductofery provide a wide range of efficient heat therapy. Literature is available.

Space No. 306

THE ELECTRICAL RESEARCH LABORATORIES.

The New Clark Electrotherm is a standardization of the essential parts approved through the design of the Clark Hyperpyrexator, the pioneer fever apparatus using the humid air principle. The New Electrotherm will be available at a very attractive price. There will also be shown a new fever retaining couch and a new body temperature indicating resistance thermometer.

Space No. 307

PHILIP MORRIS & COMPANY, LTD.

Philip Morris & Co., Ltd., will demonstrate the method by which it was found that Philip Morris eigarettes, in which diethylene glycol is used as the hygroscopic agent, are less irritating than ordinary eigarettes in which glycerine is em-

Space No. 308

ILLE ELECTRIC CORPORATION.

A new "Under Water Therapy Tank" with Hydro-Massage and Thermostatic Control for the system of under water therapy developed by Dr. John D. Currence. A Portable Under Water Therapy Tank (An Improved Whirlpool Bath) for local application. Will also show the "Vasotherm", a thermostatically controlled heat applicator for continuous use in peripheral vascular diseases.

Space No. 309 and 310

PEERLESS LABORATORIES, INC.

Those interested in Short Wave Therapy will find in our exhibit Advanced Short and Ultra-Short Wave equipment with perfected control of energy. Friction clutch treatment arms eliminate the use of hand working devices and greatly facilitate treatment. Mercury Quartz Ultra-Violet equipment operates from Peerless Short or Ultra-Short Wave models, designed to meet the requirements of the physician or hospital.

Space No. 311

CAMERON SURGICAL SPECIALTY COMPANY.

New and inexpensive models of Cameron Cauterodyne (Radio Frequency) which provides safe and efficient cutting, coagulating, desiccating and fulgurating with a quick-healing, bloodless field for all phases of surgery. Latest developments in electrically lighted lamps and instruments for surgery and diagnosis also will be shown.

Space No. 312 and 313 FANGO CORPORATION OF AMERICA.

Exhibit of Fango di Battaglia, the natural volcanic de posit, used universally in the application of MOIST PENE TRATING HEAT packs, in rheumatic and allied disorders. Attendants will gladly give full information regarding the technic of application and arrange for practical demonstration.

Space No. 314 and 315 LIEBEL-FLARSHEIM COMPANY.

See the complete L-F Line of Short Wave Generators and Bovie Electro-Surgical Units. Take the opportunity to visit our factory while in Cincinnati.

Space No. 316 and 317 E. I. ROSE MANUFACTURING COMPANY.

You are cordially invited to visit our booths and receive a demonstration of the completely new ultra-modern line of physical therapy equipment, including the new CX-2 Radia-thermy Unit with four built in frequencies of 6, 9, 12 and 16 meters, also incorporating both the induction cable and condenser type applicators. Also, a complete line of Cold Quartz Ultra-Violet Lamps.

Space No. 320

R. J. LINDQUIST & COMPANY.

Chronaximeter for new methods in muscle testing. Chronowave—Low Volt Generator. No motors, no rotating parts. Completely controlled wave forms. A new contractile curtent based on tests of the normal chronaxia. Short Wave bathermy Apparatus—Portable-console combination units. Desert Sur—Infra-Red and Ultra Violet Lamps.

Space No. 321 BROWNIE ELECTRIC & MFG. COMPANY.

Paraffin Baths built by the Brownie Electric & Mfg. Co., have been tested for several years in Cleveland hospitals. They have a perfected positive control of the electrical melting and operating elements. Tub of Stainless Steel. Casing of Chrome Plated Steel. Elements carefully built into each individual Bath.

Space No. 322

U. M. A., INC.

The COLL-WIL Intermittent Venous Occlusion apparatus, used for the therapy of Peripheral Vascular Disease in all the important climes of the country. There will also be shown a new simple skin thermometer, a fast reading Thermo-Couple and a new oscillometer.

Space No. 323 and 324 McINTOSH ELECTRICAL CORPORATION.

Will show a complete array of latest developments in Physical Therapy Equipment. The new Hogan Ultra-Brevatherms (ultra short wave lengths) will be exhibited, as well as the Short-Wave Hogan Brevatherms, available in several sizes and power ranges and priced accordingly. The Polysine Generator, Modernistic Sinustat, the Biolite Infra-Red Generators and other apparatus also will be displayed.

Space No. 325

THE WM. S. MERRELL COMPANY.

The Wm. S. Merrell Company has been supplying the medical and pharmaceutical profession of the United States with distinctive products for 109 years. Our new laboratories and offices have just been completed at Reading, on the outsirts of Cincinnati. You are invited to visit us during your tay in Cincinnati.

pace No. 326

Y.

HE BECK-LEE CORPORATION.

Announcing the showing of our new ELECTRO-CARDIO-RAPH which has many practical and novel features. Our gular line of Short Wave Diathermy apparatus needs no troduction. It will pay you to stop at our Booth.

Space No. 327

J. H. EMERSON.

The latest model Emerson Suction-Pressure Boot and blood pressure cuff for intermittent venous constriction to produce hyperemia in the extremities, for treatment of certain types of peripheral vascular diseases. There will also be shown other types of interesting equipment.

Space No. 328

DIERKER COMPANY - MANUFACTURERS.

Dierker Therapeutic Apparatus for administering treatments and medication to accessible cavities; reprints of scientific papers by eminent clinicians, who are users of the Dierker Apparatus, will be available upon request. Ask your local dealer to supply you.

Space No. 329 and 330

ADLANCO X-RAY CORPORATION.

THE ORIGINAL SIEMENS ULTRATHERM and smaller models of Ultra Short Wave apparatus will be shown. Do not miss seeing, also the SMALLEST yet MOST POWER-FUL PORTABLE X-RAY APPARATUS, "HELIO-SPHERE", for Fluoroscopy AND Radiography! 100 per cent shock and ray proof!

Space No. 331

THE COCA-COLA COMPANY.

Coca-Cola will be served to the delegates of the American Congress of Physical Therapy with the compliments of the Coca-Cola Company.

Space No. 334

MAJESTIC SURGICAL INSTRUMENT COMPANY.

The latest in short wave and electrosurgical combination portable and cabinet model short wave unit, and the Majestic portable electrosurgical unit will be exhibited.

Space No. 335

AMPEREX ELECTRONIC PRODUCTS, INC.

Complete line of power tubes, air and water cooled, with many types particularly suitable for use in Short Wave Diathermy equipment.

Space No. 336 and 337

GENERAL ELECTRIC X-RAY CORPORATION.

Several new developments in the field of fever therapy by the induction method which have resulted in the production of a new type of fever cabinet will be shown, along with the inductotherm and other allied products. This fever cabinet is all metal, light in weight, and inexpensive.

Space No. 338

SCIENCE LABORATORIES, INC.

Mercury Quartz Lamps for professional use only.

Space No. 339 and 346

GARFIELD HIGH FREQUENCY LABORATORIES, INC.

Garfield High Frequency Laboratories, Inc., affiliated with the S. Corrugated Quenched Gap Co., Garfield, New Jersey, manufacturers of high speed heat generators for the past fifteen years, also producing the Garfield Ultra Short Wave Diathermy machines, embodying every latest advanced principle of producing heat stimulation, surgery, and coagulation, including automatic resonance control.

Space No. 342

PROFESSIONAL EQUIPMENT COMPANY.

The Professional Equipment Company, Chicago, sole distributors for the Fischer Corporation of Glendale, California, will display a full line of Fischer products. Their exhibit will show the latest developments in Short Wave Therapy Equipment as well as Cold Quartz Ultra Violet Lamps.

Space No. 343

TREATMENT REGULATOR CORPORATION.

Elliott Treatment Regulator circulates a constant supply of hot water through anatomically-shaped Latex applicators. Applicators are evenly distensible and when inserted in oriheial hody cavity fill cavity entirely, radiating heat evenly and uniformly. Pressure and maintained high temperature are under physician's control.

Space No. 344

CONDUCTO-THERM CORPORATION.

The HUMIDITHERM Therapeutic Fever apparatus is an equipment using circulated, humidified, heated air as the means of inducing pyrexia or hyperpyrexia. This apparatus is mobile and is used in connection with a hospital bed; it functions satisfactorily for high sustained treatments in

Space No. 347

TAYLOR INSTRUMENT COMPANIES.

The Paevex for treating circulatory diseases of the ex-tremities will be displayed. Be sure to see the photographs on display showing the results obtained from the proper use on display showin of this equipment.

Space No. 348

C. V. MOSBY COMPANY.

Will exhibit its complete line of medical publications. Visitors attending the convention are especially invited to inspect the new book on "Physical Therapeutic Methods in Ottolaryngology," by Hollender. Also on display will be Meakins "Practice of Medicine," the famous Synopsis books; Saller, "Theory and Practice of Psychiatry"; Sutton, "Physical Diagnosis," and many other brand new works.

Space No. 350

THE BATTLE CREEK FOOD COMPANY.

You are invited to inspect the nationally known line of Battle Creek Special Purpose Foods. Special foods for diabetic, the reducer, and those who wish to gain weight; special foods for changing the intestinal flora, as well as regulating foods. Full information available from attendants.

Space No. 351

WARREN E. COLLINS, INC.

A new unbreakable suction-pressure therapy boot for the Collins Vasculex has warming units to relieve incidental arteriospasm. Prevention of anoxemia and circulatory failure during fever therapy is aided by the use of oxygen herapy with the Collins Oxyflo. Register at booth for reprints and technical literature.

Space No. 352, 353 and 354

H. G. FISCHER & COMPANY.

The latest FISCHER Model of Short Wave, X-Ray and other apparatus, will interest physicians because of their many unique features of design and performance. The complete FISCHER line includes Shockproof X-Ray apparatus, Short Wave Units, Combination Cabinets, Galvanic Generators, Ultra Violet and Infra-Red Lamps; Tissue-cutting and other units, accessories and supplies.

Space No. 355 and 356

LEPEL HIGH FREQUENCY LABORATORIES, INC.

See our demonstration of mobile short and ultra short wave machines, mobile portable short wave model, ultraviolet equipment capable of being energized from the models mentioned above or obtainable with a generator; and the Leplex portable X-ray unit.

Space No. 357 and 358

NATIONAL CARBON COMPANY, INC.

This exhibit will consist of the complete demonstration of the new Eveready Professional Model Carbon Arc Lamps, Models L1 and A2 and the new Eveready Two-bed Carbon Arc Lamp, Model A22. A new principle of carbon arc operation using high intensity carbons has been applied to both the Model A2 and Model A22 Lamps. Very high intensity of ultraviolet output, as well as exceptional efficiency is thus obtained.

Space No. 359

C. COY HONSAKER.

Inspect the Honsaker Hydro-Eneciator, an apparatus for inducing Artificial Fever, using a medium of highly humidified air and finely atomized water at low surface temperature; also the Honsaker Colonic Lavagatory, for administering scientific colon treatments.

Space No. 360 and 361

HANOVIA CHEMICAL & MANUFACTURING COMPANY.

Don't fail to learn all about the new Luxor S Model Alpine Sun Lamp just introduced. It has features never before possible and required many years of research to per-fect it. Hanovia's complete line of apparatus will be shown.

Space No. 362

THE WOCHER COMPANY.

Introducing WOCHER products, including physical therapy equipment, to members of the Congress. Other items will be on display in our store, one of the largest in the United States, located one square from the Netherland Plaza Hotel. We manufacture surgical supplies of every kind and cater to the medical profession.

Space No. 363

PAUL E, JOHNSON, MANUFACTURER.

Every physician can now afford — "Everything in Physical Therapy." Introductory Combination Offer: Hyperpyrexia — electrosurgery — short and ultra-short wave — galvanism — sinusoidal — luminous infra-red rays — body and orificial quartz ultraviolet — air and water cooled carbon are lamps Complete equipment — at an unusually low price. If you're after true economy — See our Exhibit.

Space No. 364

HOLLAND-RANTOS COMPANY, INC.

The Rantos FEVER BAG, designed as an accessory to fever-inducing apparatus, represents an economy by eliminating use of expensive equipment too long with any ore patient. The machine may be turned off after the temperature has been raised, the heat retaining bag maintaining temperature for five or six hours. RANTOSILK represent finest quality in featherweight waterproof sheeting, bedding and garments.